Starchy Staples Value Chain Review
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### 1. Abbreviations and Acronyms

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<th>Full Form</th>
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<tbody>
<tr>
<td>ACTIV</td>
<td>Alternative Communities Trade in Vanuatu</td>
</tr>
<tr>
<td>AMA</td>
<td>Agriculture Marketing Authority</td>
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<tr>
<td>APTC</td>
<td>Australia-Pacific Technical College</td>
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<tr>
<td>AQIS</td>
<td>Australian Quarantine and Inspection Service</td>
</tr>
<tr>
<td>AusAID</td>
<td>Australian Agency for International Development</td>
</tr>
<tr>
<td>CBDV</td>
<td>Colocasia Bobone Disease Virus</td>
</tr>
<tr>
<td>CEMA</td>
<td>Commodities Export Marketing Authority</td>
</tr>
<tr>
<td>CIRAD</td>
<td>Agricultural Research for Development</td>
</tr>
<tr>
<td>DEEDI</td>
<td>Department of Employment, Economic Development and Innovation, Queensland</td>
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<tr>
<td>DMV</td>
<td>Dasheen Mosaic Virus</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
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<tr>
<td>FACT</td>
<td>Facilitating Agricultural Commodity Trade</td>
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<tr>
<td>FAO</td>
<td>Food and Agriculture Organisation of the United Nations</td>
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<tr>
<td>FIMCO</td>
<td>Friendly Islands Marketing Cooperative</td>
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<tr>
<td>FSA</td>
<td>Farm Support Association</td>
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<tr>
<td>GI</td>
<td>glycaemic index</td>
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<tr>
<td>HACCP</td>
<td>Hazard Analysis Critical Control Point</td>
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<tr>
<td>HKL</td>
<td>HK Logistics</td>
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<tr>
<td>HTFA</td>
<td>High Temperature Forced Air</td>
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<tr>
<td>ICM</td>
<td>Integrated crop management</td>
</tr>
<tr>
<td>KOFA</td>
<td>Kiribati Organic Farmers Association</td>
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<tr>
<td>MAF</td>
<td>Ministry of Agriculture and Fisheries, Samoa</td>
</tr>
<tr>
<td>MAFFF</td>
<td>Ministry of Agriculture and Food, Forests and Fisheries, Tonga</td>
</tr>
<tr>
<td>MAGFF</td>
<td>Ministry of Agriculture, Quarantine, Forestry and Fisheries, Vanuatu</td>
</tr>
<tr>
<td>MAL</td>
<td>Ministry of Agriculture and Livestock, Solomon Islands</td>
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<tr>
<td>MELAD</td>
<td>Ministry of Environment Lands and Agriculture Development</td>
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<tr>
<td>MOU</td>
<td>Memorandum of Understanding</td>
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<tr>
<td>MPI</td>
<td>Ministry of Primary Industries</td>
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<td>NASAA</td>
<td>National Association for Sustainable Agriculture Australia</td>
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<tr>
<td>NGO</td>
<td>Non-government organisation</td>
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<tr>
<td>PARDI</td>
<td>Pacific Agribusiness for Development Initiative</td>
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<tr>
<td>PGS</td>
<td>Participatory Guarantee Scheme</td>
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<tr>
<td>Abbreviation</td>
<td>Description</td>
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<td>--------------</td>
<td>--------------------------------------------------</td>
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<tr>
<td>PHAMA</td>
<td>Pacific Horticultural and Agricultural Market Access</td>
</tr>
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<td>PITIC</td>
<td>Pacific Islands Trade and Investment Commission</td>
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<tr>
<td>Qld</td>
<td>Queensland</td>
</tr>
<tr>
<td>RAMSI</td>
<td>Regional Assistance Mission to Solomon Islands</td>
</tr>
<tr>
<td>RMT</td>
<td>Rapid Multiplication Techniques</td>
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<tr>
<td>SPC</td>
<td>Secretariat of the Pacific Community</td>
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<tr>
<td>SROS</td>
<td>Scientific Research Organisation of Samoa</td>
</tr>
<tr>
<td>TaVCV</td>
<td>Taro vein chlorosis virus</td>
</tr>
<tr>
<td>TLB</td>
<td>Taro Leaf Blight</td>
</tr>
<tr>
<td>TZSV</td>
<td>Tomato zonate spot virus</td>
</tr>
<tr>
<td>UQ</td>
<td>University of Queensland</td>
</tr>
<tr>
<td>USP</td>
<td>University of the South Pacific</td>
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</table>
2. Acknowledgments

The researchers appreciate the generous feedback from the 103 businesses and organisations interviewed which comprises the content of this report, and Associate Professor Kim Bryceson, School of Agribusiness, University of Queensland who led the Horticulture Component visit.
3. Executive summary

In 2010 PARDI’s Horticulture Component team visited the six countries in PARDI – Fiji, Kiribati, Samoa, Solomon Islands, Tonga and Vanuatu – to interview participants in the supply chains for starchy staples for the express purpose of identifying potential projects that would result in higher value products being delivered to higher value markets through more efficient supply chains. The specific objectives were:

- to explore opportunities to add value to key crops
- to identify constraints in the supply chain that are impeding industry development
- to assess what assistance is needed to realise these opportunities and overcome constraints, that PARDI projects could provide
- to identify chain leaders likely to drive future projects.

The short country visits targeted wholesalers, exporters and processors. Government and non-government agencies supporting the target industries, retailers and chefs were also interviewed where time permitted, and Pacific Islander importers and retailers were visited in Brisbane and Sydney.

The initial crop list of taro, cassava, yams, breadfruit and coconut was expanded to include sweetpotato and English potato as the visits progressed. Other vegetables, cocoa, coffee and vanilla, and tropical flowers in Vanuatu were explored on an ad hoc basis when the occasion arose.

The interviews found opportunities for these industries to:

- build domestic markets and improve food security in all the PARDI countries for all crops
- improve profitability through value adding of all products and reducing losses along the whole supply chain
- expand local markets through extending the supply season for vegetables with crop protection and suitable cultivars
- meet growing demand for potato, sweetpotato, other vegetables and tropical fruits by supplying higher value domestic markets with market-preferred cultivars through hotels, restaurants and supermarkets
- increase export value to existing and potential new markets through higher value fresh and processed products.

While industries vary across the six countries and individual crops, a number of common key constraints are apparent:

- Production capacity is limited by lack of timely supply of planting material and affordability of inputs
- Production systems need improving to minimise soil degradation, environmental impact, pest and disease infestation
- New market development is constrained by inconsistent supply, due largely to low farmgate prices providing little incentive for loyalty to individual buyers, and poor grower understanding of cultivars preferred by end consumers and processors
• Poor post-harvest handling and packaging and inadequate cool chain management and co-ordination are downgrading product quality, pricing, and ability to meet the import requirements of higher value overseas markets and deliver a quality product to the end consumer.

• Processing is mostly focussed on low value undifferentiated products in substandard packaging, delivering marginal profits.

• Processing quality and viability is affected by insufficient processing knowledge and quality management and a lack of quality standards, resulting in wide variability in product attributes which is extenuated by intermediaries consolidating numerous cultivars with unknown processing characteristics.

• Higher value markets in the Pacific Islands are being bypassed for exports of low value products due to strong demand signals from importers back to growers.

• Long distribution channels are not delivering the market feedback necessary to guide quality management along the supply chain.
4. Introduction

Value chain interviews were undertaken in Fiji, Kiribati, Samoa, Solomon Islands, Tonga, Vanuatu and Australia as part of the Horticulture Component of the Pacific Agribusiness for Development Initiative (PARDI) to identify opportunities that would deliver benefits to starchy staple industries in both the Pacific Island countries and Queensland.

Visits to Fiji, Kiribati, Samoa, Tonga and some Vanuatu businesses were undertaken by the component leader, an associate professor in agribusiness at the University of Queensland (UQ), and a trade officer and an extension agronomist from the then Department of Employment Economic Development and Innovation (DEEDI), Queensland, between May and September 2010. The DEEDI staff also carried out further interviews in Vanuatu and Solomon Islands. Additional value chain interviews were conducted in Australia for specific products.

**Purpose**

The purpose of the country visits was to review value chains and identify opportunities for potential projects in starchy staple crop industries that result in more efficient supply chains as higher value products in higher value markets. The specific objectives were:

- to undertake supply chain interviews for key starchy crops
- to explore opportunities to add value to key crops
- to identify constraints in the supply chain that are impeding industry economic development
- to identify the assistance needed to realise these opportunities and overcome constraints, that PARDI projects could provide
- to identify chain leaders likely to drive future economic opportunities.

**Methodology**

Semi-structured and unstructured interviews were conducted with 103 agribusinesses and supporting organizations in six Pacific countries and with importers and Pacific Islander retailers of the target foods in Brisbane and Sydney. The information collected was recorded and data passed on to ACIAR and PARDI partners with relevant projects in the specific industries. An executive summary and research findings are presented in this report.

**Research scope**

The primary focus of the interviews was the taro, cassava, yam and breadfruit industries, which were recommended as priorities by the PARDI management.

Interviews in Fiji identified similar issues for sweetpotato and to some extent potato, so these were added to the list of starchy staple crops for assessment from that point onwards. For this reason they lack the same degree of assessment as the four principal crops.

Following the expressed interest in virgin coconut oil by PARDI management at a Brisbane planning forum, this was also investigated as a secondary crop in all countries.

Additional interviews were undertaken with representatives of other vegetable, fruit and small crops, including cocoa, coffee, vanilla and ginger. For example, PARDI asked the researchers to interview a tropical fruit processor in Fiji and also Fiji hotels using imported produce. Processors of starchy staples usually handled other products such as ginger, duruka and a number of vegetable lines, so interviewers took into consideration the possibility of processing projects across a number of crops using a common processor.
DEEDI researchers conducted some limited interviews looking for commonality of research issues for developing Queensland crops such as cocoa and coffee. A Vanuatu flower processor who was keen to enlist ACIAR support for a proposed project was interviewed and referred to the Secretariat of the Pacific Community (SPC) for consideration. All interviews were recorded, and data passed on to ACIAR and PARDI partners with relevant projects.

Table 1: Crops investigated

<table>
<thead>
<tr>
<th>Starchy staples</th>
<th>Other vegetables</th>
<th>Tree crops</th>
<th>Herbs and spices</th>
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<tbody>
<tr>
<td>Breadfruit</td>
<td>Capsicum</td>
<td>Banana</td>
<td>Vanilla</td>
</tr>
<tr>
<td>Cassava</td>
<td>Chillies</td>
<td>Cocoa</td>
<td></td>
</tr>
<tr>
<td>English potato</td>
<td>Duruka</td>
<td>Coffee</td>
<td></td>
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<tr>
<td>Sweetpotato</td>
<td>Ginger</td>
<td>Mango</td>
<td></td>
</tr>
<tr>
<td>Taro</td>
<td>Eggplant</td>
<td>Papaya</td>
<td></td>
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<tr>
<td>Yam</td>
<td>Lettuce</td>
<td>Pineapple</td>
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<td></td>
<td>Okra</td>
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<td></td>
<td>Tomato</td>
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<td></td>
<td>Zucchini</td>
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As a key objective was to identify potential supply chain leaders who could deliver widespread benefits to small producers to promote food security, the interviews concentrated on distributors, processors and exporters and supporting non-government agencies. Ministries for agriculture and other government agencies were also interviewed in Tonga, Solomon Islands and Vanuatu after advice by PARDI stakeholders at a PARDI planning forum in Nadi.

Limitations

The research purpose was to conduct agribusiness research, specifically to identify issues and opportunities for value chains of starchy staples – taro, cassava, yams and breadfruit – in the targeted countries and ensure that the implementation of findings could support industry expansion to improve food security and improve product value and returns for supply chains in the respective countries. It was not intended, or feasible, to conduct detailed mapping of any supply chains and value chains on such a broad-based scoping visit.

The itineraries for each country were developed from ACIAR profiles on key crops, industry reports, analysis of trade data, internet business listings and media articles, contact databases and ad hoc referrals before and during each visit. Larger companies specializing in root crops were targeted as limited information was available about smaller businesses. While interview schedules attempted to follow individual supply chains, this was rarely feasible on an initial scoping visit as it could not be expected that companies would divulge commercial information to strangers ahead of the initial meetings. Therefore the team interviewed key representatives of each target level of the supply chain.

Taro was considered a priority crop in the target countries due to strong export revenues, with distributors and processors usually handling the other starchy staples as secondary products. This resulted in taro being researched more thoroughly than the other crops.
Issues regarding inputs were explored from the perspective of distributors, processors, exporters and some retailers, and assumptions about consumer attitudes were extrapolated from their perspectives. No consumer research was undertaken.

The report structure presented follows the levels of the supply chain to depict product and information flows and relationships within and between the businesses interviewed, in order to link identified market opportunities to production, distribution and processing. However, no supply or value chains were formally mapped.

**Presentation of findings**

The component leader submitted the requisite report for the Horticulture Component activities in May 2011 (Attachment 2).

PARDI management asked the component leader to arrange a workshop in Brisbane in November 2010 for PARDI partners and stakeholders to prioritise project areas. An analysis of the data from the market visits was prepared by DEEDI, in the form of key opportunities and constraints for each industry across the six PARDI countries. This was incorporated in the horticulture component team presentation at the workshop. The group then prioritized the areas where horticulture projects should focus as: sweetpotato, vegetable seeds, virgin coconut oil, vegetables to hotels, processing, and livelihoods and capacity building. Project partners were then invited to develop projects.

Findings from coconut industry interviews were delivered to PARDI in the report *Coconut Value Chain Review* by the Secretariat of the Pacific Community, Queensland Government and University Adelaide in 2011. Therefore coconut has not been included in this report; however, the businesses and organizations interviewed specifically on coconut are acknowledged in its references.
5. Research findings – starchy staples

This section presents a collation of information gathered for taro, cassava, yam, breadfruit, sweetpotato and potato in Fiji, Kiribati, Samoa, Solomon Islands, Tonga and Vanuatu.

Root crops and breadfruit are all starch-based with the same chemical make-up, so have a short shelf life which causes the same constraints post-harvest (Lebot, 2010).

The typical product flow is through lengthy conventional distribution channels with a strong focus on export markets (Fig: 1).

Taro

Taro is a staple food in the Pacific Islands, but production is declining due to scarcity of low cost labour, deteriorating soil fertility and the impact of pests and disease (ACIAR: Taro).

Fig. 1: Typical supply chain for starchy staples in the PARDI countries

Fiji

Taro has become Fiji’s leading root vegetable in recent years, although production of 60,283t in 2010 represents a 21 per cent drop over the previous five years. Taro supply has been affected by cyclones and floods, and expansion of production is constrained by lack of available freehold and cultivatable land. Exports have grown steadily to 15,000t in 2009, while domestic production has replaced previous imports from Samoa.
**Production**

The large industry is due to strong export demand and growers shifting from other crops. Around 70 per cent of taro is grown on the volcanic island of Taveuni, where it is the leading crop as local soil conditions and climate suit taro and enable year-round production. However, there are times of inadequate water supply due to the very free draining nature of the soils, the rocky soils prevent mechanisation of production, and overcropping has led to declining yields. The Ministry of Primary Industries (MPI) is encouraging new development on Viti Levu to spread the supply base due to crop losses from cyclones on Taveuni.

Producers range from smallholder growers to large vertically integrated operations, and from intercropping to monocropping.

Growers always fallow their ground after a taro crop. When grown commercially with minimal fallow taro requires fertiliser input, but many small growers cannot afford the high cost of fertiliser. MPI has been trialling crop rotation and green manure crops.

Producers lack knowledge and skills across all aspects of production and need technical extension in agronomy, plant nutrition, soil improvement and management and water management as well as business skilling. MPI officers provide some technology and business support but need further training to provide adequate extension.

Planting material is in short supply and often too expensive for small growers, so the MPI sometimes provides it. The Agriculture Marketing Authority (AMA) and District Commission also provide management extension as well as micro-finance for inputs. Replanting after natural disasters is constrained by the high cost of finance to buy inputs and lack of affordable insurance. The MPI encourages growers to plant through loans, typically FJ$2,000–3,000 (AU$1,090–1,640), to buy planting material, and checks their progress. The Government has also agreed to prioritise crop insurance.

Taro cultivars are loosely grouped as pink (known as Tausalo or Niui), white, yellow and hybrid. The leading cultivars are Tausalo — grown on Taveuni, Viti Levi and Vanua Levu — and Niui Pink. Only Tausalo (also called “Fijian taro” and “Samoa pink”) has sufficient shelf life for export. However, the industry does not have product standards based on attributes such as consumer colour preferences or end use requirement.

Quality and yield are being affected by soil borne pests and diseases. The Taveuni industry has managed to remain free of taro beetle through maintaining clean production areas and harvesting at five months, but other areas being promoted for taro production are beetle-affected. On Taveuni large corms are prone to ‘roka’, a watery condition linked to very wet growing conditions.

The industry currently lacks an agricultural association that could support smaller producers and ethnic groups. Although the Fiji Government is trying to create a Taro Council, previous efforts at associations have failed due to a high level of competition between growers.

Price fluctuation occurs at the farm level with buyers competing fiercely and growers shopping around for the best price. Processors and other users complain of a lack of grower loyalty, with disregard for supply contracts once the crop is harvested.
Processing

Most processing consists of washing, peeling, slicing and freezing, either at the wholesaler’s distribution centre or at commercial factories. Processing is labour-intensive, requiring workers to cut off the top, clean the corm well, shape the base to meet import protocols or peel and freeze, and pack the containers for different markets. Some processors blanch the taro before freezing to prevent discolouration. Fresh taro is expensive to process to Australian import requirements. Frozen product gives 100 per cent useable flesh, is more convenient to distribute, and meets quarantine requirements of importing countries.

Manufacturers produce mainly taro crisps for local markets and canned palusami (coconut cream wrapped in taro leaves – a popular Fijian dish) for export.

Some processors, frustrated at the lack of sufficient supply to allow batch-processing, are going into production to ensure sustainable supply. Others encourage growers’ loyalty to the processors by providing training to meet specifications, collection of the raw product, and quality management. For example, the Government’s food processing company has implemented a contract-growing program to source trustworthy growers who will honour their contracts and meet its grading standards. These growers are then supported by company extension advisors.

Processors also have difficulty obtaining taro of processable quality due to poor postharvest handling practices by growers and distributors. For example, taro often develops mould after three or four days in a sack en route to the factory. One processor has been considering providing a quality assessment hub using its micro testing lab to support the development of quality standards.

Processors want to be able to secure sufficient supply of the varieties found to process well. There has been no research on the processing suitability of specific cultivars, although some very good yellow fleshe varieties are reported to have potential. A company processing taro crisps from pink Tausalo and yellow Malakindala varieties experiences considerable variation in quality, which impacts on the running of its automated plants and ultimately on its profitability. This variation is due to the varied processing capabilities of the taro varieties; to varietal names being used in a generic sense rather than relating to a specific cultivar; and to the taro being sourced from aggregators who buy from a range of growers and production regions, from commercial plantings to taro grown in backyards or vacant land. Some cultivars, mainly yellow-fleshed, have high levels of oxalates which have caused itchy throats in some consumers, particularly children, and skin irritation in workers peeling fresh taro.

Food safety is enforced by the Ministry of Health, whose spot inspections and safety checks have identified high levels of E. coli in taro. Processors are increasingly food safety conscious and introducing full HACCP (Hazard Analysis Critical Control Point), which will require making the whole chain compliant, including training growers to cease using unprocessed animal manures. One processor said they try to source taro grown with minimal insecticides and pesticides.

Despite local demand, efforts to process taro flour as a baking ingredient and a substitute for imported flours have shown a lack of competitiveness against alternatives.
While demand for taro crisps is growing from hotel bars and shops, the local market is highly price-sensitive, and a processor sees the need to lower its production costs significantly to compete with imported crisps and other bar snacks.

For processing companies to become more competitive will require a more homogenous supply of taro, research to identify varieties suited to processing, and development of product standards required of suppliers.

Other products being discussed include:

- Low pressure fried crisps to reduce oil uptake and browning, as done in Malaysia
- Taro paste, as produced in Hawaii
- Using taro in a vegetable paste to make noodles more nutritious, especially for children, given the impact of FJ$30 million annual imports of ‘two minute’ noodles.

**Distribution**

Intermediaries interviewed ranged from larger fully integrated grower/exporters to lengthy arrangements using brokers and regional branches. They are often family businesses.

Primary distributors are based in the area of production, buying through commission agents or the company’s own representative, and consolidating small quantities from numerous village growers, and are responsible for post-harvest management. Their agents buy for cash at the farmgate, from up to 200 producers who plant on two to four week cycles, and provide an important transport service in remote areas such as Taveuni where growers often do not own vehicles. Distributors compete for growers, who tend to be opportunistic and sell on price only. Small distributors often emerge and pay higher but unsustainable prices to growers before exiting, which unsettles growers and other long term distributors and results in disruptions to product supply. Buyers may advance seed funds to growers to win loyalty to counteract the influence of best price operators.

Usually the agent brings the taro to the local wholesaler’s central collection point where it is checked for disease, sorted and packed in hessian bags. On Taveuni the bags are loaded on a truck which travels on the car ferry overnight to Suva, offsetting the freight cost through backloading. Payments to growers are reduced by costs such as shed leases and substantial seafreight charges to Suva, giving Viti Levu growers a cost advantage. Supply is also affected by delays and cancellations of the shipping service from Taveuni via Savusavu to Suva.

Most processing occurs in the secondary wholesalers’ packsheds, usually located near air and seaports, where they process and package the fresh and frozen taro, pack the containers, and export the fresh taro by air freight from Nadi and frozen taro by seafreight from Suva.

There are currently seven or eight exporters on Viti Levu, mostly near Suva, and usually handling a range of starchy staples and sometimes other vegetables. According to an exporter, taro exports usually only provide 10 – 20 per cent profit but can be used to fill containers and obtain better freight rates.

Importers, mainly in Australia, New Zealand and the United States, distribute through Pacific Islander retailers, churches and community groups. The importer is often from the same or similar cultural group. In Australia the largest importer is South Pacific Distributors, who supply Pacific Islander retailers under its own brand.

Poor post-harvest handling, hygiene and cool chain management are affecting quality. Rough handling and over-handling are causing bruising, and some argue that a central packshed would allow growers to bring taro in their own vehicles. Sweating, mould, sprouting and rots are resulting from storing taro in bags, usually without proper storage and processing facilities. Taveuni lacks
mains power so fresh taro is held at ambient temperature in sheds or containers in poorly ventilated warehouses. It should be noted that Taveuni’s average annual temperature range is 22°C – 30°C with 75 – 83 per cent relative humidity. Sun damage and lack of cool transport systems are major issues. It usually takes two days by sea and road in unrefrigerated transport to travel from Taveuni to an export packshed with coolroom facilities on Viti Levu. Breakdowns in hygiene are also contributing to rots, and some exporters are implementing HACCP to address this. In addition to the Taro Exporters Agency, exporters see the need for the Ministry of Primary Industries to prescribe export standards.

Fresh taro has good shelf life, but once trimmed lasts only two to four days, so exporters are using air freight to Australia. However, this mode still carries risk as a reefer can sit for two or three days at Nadi or Sydney Airport waiting for a customs inspection, and when an overseas flight is delayed the distributor can only leave the processed taro stored in the coldroom. Also, taro exported in bags often arrives wet and slimy. Consequently Fiji exporters often ask for cash payment or part-payment in advance, or send frozen taro.

Some exporters are having difficulty meeting quarantine protocols in Australia and New Zealand for fresh taro, and one exporter does a 100 per cent inspection during grading to check for insects to avoid incurring quarantine penalties. Australian Quarantine and Inspection Service (AQIS) requires taro to be fumigated or returned to the exporter in Fiji if grass seeds, disease, taro nematode, scale, mould, suspected fungus, bacteria, dirt, Giant African snail and other pests and diseases are found. Unless the importer cleans every taro and returns the consignment to AQIS’s bond store, the whole container is condemned. Only its skin protects taro and maintains its shelf life, and once peeled it must be refrigerated and sold within one to two days. Fumigation causes the skin to break down, spoiling the colour and appearance and reducing the shelf life from four weeks to one, so stock has to be heavily discounted to sell quickly. Fresh taro leaf is not exported to Australia as it is killed by the fumigation required by AQIS.

All these import risks and associated costs are met by the exporter and/or importer. Identifying found insects, fumigation, and disposal of condemned product by quarantine in Australia and New Zealand is expensive. Fumigation of containers costs AU$800 – 1000 per air freight container, and AQIS requires taro to be x-rayed and held for seven days before releasing, with the importer paying for the storage. New Zealand quarantine charges FJ$1000 (AU$545) if it needs to do an insect identification. Food testing in Australia costs AU$2,000 per import batch. Losing a container may cost exporters up to FJ$20,000 (AU$10,900) plus any dumpage costs at the market end. Taro exports rejected by the importer are returned to the exporter who then may sell them at local markets. Due to the high risks some importers buy on consignment and pass any treatment and/or dumpage costs to the exporter.

An importer observed the need to explain to growers the consequences of quarantine issues and of not cleaning the product properly, and suggested that AQIS make an inspector specialised in taro available to discuss potential solutions or have the taro inspected and treated in Fiji before export. Also, if AQIS provided the inspection report the importer could properly inform the supply chain in Fiji of the issue.

These problems have caused exporters of fresh taro to switch to other markets, in mainly New Zealand, the United States and Tuvalu, or to frozen taro. While the United States offers an attractive potential market for fresh taro, Fiji lacks an import protocol there, so exporters are restricted to frozen taro. Shipping frozen taro to Canada incurs additional transhipping costs in Hawaii.
While frozen taro fetches half the price of fresh product, quality is not subject to the same import impediments, or affected by the 13 – 14 day sea voyage to Australia or four day shipping time to New Zealand, or by shipping delays and lack of ships visiting Fiji for up to a fortnight at a time.

**Domestic consumers**

While taro is considered a basic food item, consumers are increasingly shifting to rice, and young Fijians also eat potato french fries, so there are some signs of market saturation for taro. There is potential to expand the market for taro crisps and to promote taro as a suitable low glycaemic index (GI) food for Fiji’s large percentage of diabetics.

**Retail and food service**

Fresh taro is sold widely in retail stores and wet markets, and leads the root vegetable category for the largest retail chain, mainly the yellow-white type. Taro is difficult to source after weather events such as cyclones, and this retailer is looking to buy directly from growers in the production regions.

Tourist hotels offer taro with other local root vegetables on menus and buffets in Fijian themed banquets and fusion dishes. Taro is boiled or baked in traditional lovo (earth ovens), and the leaves used to make palusami. Hotel chefs can easily acquire any of the starchy vegetables, but need better quality taro and prefer to buy fresh and processed taro produced under a HACCP system. Taveuni hotels buy small corms for staff meals.

Taro crisps are sold by smaller retailers and served on some Air Pacific flights. The main outlets for taro crisps are hotels and their shops. The hotels offer the crisps in their bars as a salty snack to encourage drinking, although it is often easier and cheaper to serve large containers of peanuts.

**Overseas markets**

Taro is an important export commodity valued at AU$19 million a year (Food and Agriculture Organisation of the United Nations). There is strong demand for fresh and processed taro, with growing orders and new buyers. The main markets are Australia, New Zealand, United States, Canada, and other Pacific Island nations. The main consumers are expatriate South Pacific Islanders in those countries, including:

- **Australia** – expatriate Fijians, Fijian Indians, Melanesians, Polynesians and Vietnamese in Brisbane and Sydney, who buy Pacific taro and also Queensland Bunlong. Demand is strong for around five to six containers of imported taro a week of fresh and frozen taro. The Australia and New Zealand markets prefer fresh Samoan pink taro (Tausalo).
- **New Zealand** – growing demand from expatriate Fijians, Fijian Indians and Polynesians for fresh and frozen taro, and a large Vietnamese market. However, young Samoans are shifting to other foods. Supply is lowest in June and July.
- **United States** – a large market of expatriate Fijians, Fijian Indians, Polynesians and American Latinos. Demand is mainly for yellow taro and pink types, and shifting from fresh to frozen taro.
- **Canada** – frozen taro for Pacific Islander expatriates through their ethnic outlets.
- **Kiribati and Tuvalu** – for Melanesian and Polynesian consumers.

Taro from Fiji competes mainly with established supply from other Pacific Island countries and Thailand, and importers are asking for larger grades and lower prices to improve their profitability.

While there are numerous taro varieties, export market demand is mainly for a narrow colour group of yellow cultivars (Fijian growers grow mostly white types) and expatriate Samoans in Australia and New Zealand want fresh “Samoan-type” pink taro (i.e. Tausalo or “Island Dalo” or “Fiji taro” from Taveuni, which originated in Samoa), and new cultivars being offered from Samoa. Samoans
also buy Giant Taro (*Alocasia macrorrhizos*). They are less concerned with country of origin. Retailers promote by colour group to meet the preferences of expatriate Melanesian and Polynesian consumers. Pacific Islanders consider Bunlong (the leading Australian cultivar) too dry and white.

Exporters rely largely on selling through friends and relatives, but are not always getting paid. Importers, mainly in Australia, New Zealand and the United States, distribute fresh and processed taro to Polynesian and Melanesian shops and churches for expatriate Pacific Islanders. Some retailers import direct, and redistribute to other stores. The leading importer in Australia requires product to be packed in Fiji under its own brand. Small exporters supplying large importers are sometimes discouraged from tracing their product through to retail.

However, growing competition and the need to discount taro after fumigation has spoilt its appearance and colour are pushing down prices for fresh taro in Pacific Islander shops, particularly in Australia, and inhibiting export development. The cost to retailers is growing significantly due to importing costs such as refrigerated shipping, fumigation and pest identification. Indian importers in Australia expect to pay AU$3.00/kg, regardless of the extra costs from the market access problems. Australian growers will not send taro to Sydney markets when wholesale price falls to AU$3.00/kg.

Retailers also sell taro leaves, although there is a greater risk of damage from quarantine treatments. A retailer/importer has ceased importing fresh taro and taro leaves because increased quarantine findings have made it too difficult.

**Samoa**

In 2010 taro production reached 17,500t, while in 2009 exports totalled 200t (FAO). Taro is the preferred crop in Samoa, being a staple food, cash crop and rotational crop in plantations with other vegetables or planted in the inter-rows of cocoa and coconuts. Until 1993 when production and exports fell sharply as a result of major outbreaks of Taro Leaf Blight (TLB) (*Phytophthora colocasiae*), the taro industry supported up to 80 per cent of Samoan families. This disease particularly affected the Samoan Pink variety. However, the commercial industry is poised for a revival now that blight resistant cultivars are being selected for distribution to growers.
Production

Samoa has many taro cultivars, grouped by colour (white and pink) and size. Commercial production is mainly of *Colocasia esculenta*, with minor plantings of the Giant Taro. There is sufficient Colocasia for domestic consumption, but as most growers plant at the same time, seasonal shortages and oversupply occur.

Industry expansion is limited by a shortage of freehold and cultivatable land and unsustainable production affecting crop yields due to land degradation from over-cultivation and farming on marginal land. Yield and quality are also affected by soil borne pests and diseases.

Most small producers cannot afford the high costs of farming inputs, including planting material, fertiliser, and the fungicides required to plant and grow out the traditional Samoan Pink taro, and lack of crop insurance and/or savings to finance inputs makes it difficult for them to recover from serious natural disasters.

A narrow genetic base makes all Samoan varieties susceptible to TLB. The Secretariat of the Pacific Community (SPC) and University of the South Pacific (USP) are collaborating and working with growers on TaroGen projects. They are also collaborating with the Samoan Government on the importation and evaluation of taro varieties. A number of varieties from Palau have been introduced for their TLB resistance and good yields. USP has engaged the Scientific Research Organisation of Samoa (SROS) to trial the new varieties. The current varieties in the breeding program cannot replicate all the preferred characteristics, so the project is backcrossing with Asian types to improve nutritional and market quality.

While the taro breeding program has a focus on nutritional value, market quality, shape and appearance for yellow and orange flesh cultivars, these characteristics, particularly nutritional composition, are very expensive to analyse and project funds are limited. The Pacific region lacks affordable nutritional analysis services other than those of USP’s laboratory in Fiji which are still too expensive for this project.

New taro varieties from Palau and Philippines have been acclimatized to accommodate the “Samoan taste”. However, some do not believe that the current varieties being developed will provide as good flavour and texture as Samoan Pink currently being supplied, or similar shelf life of two to three weeks. Further consumer research needs to be undertaken to assess what attributes are important to the market.

Five hybrids with good yields and eating quality and potential for export have been identified; however, they do not reproduce well, with only one or two suckers per plant. Thus, development of Rapid Multiplication Techniques (RMT) for propagation is important. There is strong producer demand for planting material of the new varieties. Samoa lacks commercial seed producers so the Ministry of Agriculture and SPC distribute planting material. However, supplying planting material across the islands for the new varieties requires appropriate distribution channels. There are some attempts to organise supply chains for planting material, and USP has established a taro breeding club, with costs of stock waived for members. Distributing on a large scale to meet strong industry demand and the Government’s focus on exports require substantial investment in the production and distribution of planting material.

Under the breeding program the new varieties have been distributed to farmers to trial across a wide range of environments and markets. It is expected that their feedback will direct the project’s future. Exporters have not been adequately consulted and feel they too should have been included in the trial stage. It is expected that consumer-led buying patterns will reduce the number of varieties being grown. Farmer acceptability studies show that producers want varieties that look like Samoan Pink, which expatriate Samoans in overseas markets also prefer.
As export demand for taro is strong, growers are confident of selling their entire crop, regardless of quality, so there is little incentive to grade out poor product quality. Growers show no loyalty to contracts and most are opportunistic, supplying to the distributor offering the highest price on the day.

**Processors**

The only processing is minor cottage production of taro crisps and taro flour for bakery products. Training in crisp-making has been provided by an AusAID (Australian Agency for International Development) funded course in Fiji. Upgrading a processing factory to export standards would be prohibitively costly as all equipment must be imported. There is interest in sourcing second-hand equipment for domestic and potentially export use.

A crisp-maker requires good quality taro to maximise shelf life. The preferred cultivar is Colocasia, while Giant Taro, Fijian white taro (“kalo palangia”), and Tamu, a large PNG variety, are adequate. The USP trials have boiled the new cultivars for taste-testing, but a processor has recommended testing other cooking methods. While taro is available year-round, the best quality for processing is available from May to July. Some processors also grow taro to ensure enough quantity of quality product to allow commercial processing. Taro suckers are also used in pigfeed.

**Distributors**

Exporting taro requires two to three weeks shelf life. Quality is being lost without appropriate post-harvest practices, storage facilities and transport, and a lot of product fails to reach export grade, resulting in waste from product being rejected by wholesalers, and smaller margins for the producer.

There are several distributors, with some exporting every week to American Samoa. A larger distributor buys woven baskets of taro from local producers who deliver to its depot; check the quality and wash and trim; then buy additional taro at Apia market to top up orders; and send it to American Samoa. He then travels there to handle the importation and distribution.

**Domestic consumers**

Taro is a staple in the Samoan diet, but eaten in small quantities, with a typical household consuming half a large taro a day. Samoans prefer a limited range of varieties and attributes, including dry texture for fresh eating, and use taro with wet mushy characteristics in dough for bread-making. Imported potato crisps are very popular, and the taro crisp market is growing well.

**Retail and food service**

Fresh taro is sold in all shops, and fresh peeled and roasted taro in wet markets. Tourist hotels serve taro and palusami in traditional banquets on theme nights. Local taro crisps are sold in wet markets, supermarkets, local stores, hotels and airport shops. Promoting by country of origin has improved the competitiveness of local crisps against Fijian product in retail chains. Taro offers a potential low GI food for Samoa’s large number of diabetics, and an alternative starch to the increasingly popular imported noodles, rice and other convenience foods.

**Export markets**

American Samoa is the only significant market. It has cultural links, regular shipping services, lower quality requirements than some markets, and acceptance of mixed varieties and sizes. Older people in Western and American Samoa prefer the Giant Taro.
Previous to TLB, Samoa sent 16 containers a month of predominantly Samoan Pink type to New Zealand for its large expatriate Samoan community. They continue to want this type, which is now being supplied from Fiji. While Samoa’s market re-entry will see it competing with Fiji taro, New Zealand demand estimated at 20 containers a month exceeds Fiji’s current capacity to supply.

A Samoan processor distributes taro crisps overseas through informal distribution chains of Samoan expatriates, usually relatives, who buy in bulk when visiting Samoa then distribute it back home in Australia, New Zealand, Fiji, American Samoa and Hawaii. However, the processor has not always been paid.

There seems to be opportunities in the gluten-free market, such as gluten-free bakeries in New Zealand paying NZ$8/kg (AU$6.20) for taro flour. Research is needed to understand the market for gluten-free products and the characteristics preferred for this product.

**Solomon Islands**

Taro production was 60,000t in 2010. No exports are recorded (FAO).

**Production**

Production is being severely affected by disease, including alomae virus disease complex, which distorts the leaves, and phytophthora (*Phytophthora colocasiae*). As a result growers have been shifting to sweetpotato so supply has dropped, resulting in occasional shortages of staple foods.

Lack of sufficient and suitable storage facilities and a cool chain are affecting the quality of fresh and processed taro.

To increase commercial production the following needs to be undertaken:

- Research into varieties suitable for manufacturing
- Market intelligence into customer attitudes and preferences about processed products
- Standardised processing techniques that can be used with other staples

**Processors**

There is a small cottage industry manufacturing taro crisps on Guadalcanal and other islands. The NGO Kastom Gaden has trained taro growers to make crisps and a small processor manufactures crisps from taro and other starchy vegetables for local shops and cafes. Kastom Gaden trained crisp-makers use Xanthosoma spp. taro as other varieties have given consumers itchy throats.

**Domestic consumers**

Taro is an important staple food for Solomon Islanders, and a preferred vegetable in strong demand, so attracts a premium over other vegetables, with one corm retailing at around SB$10 (AU$14.70). In the current taro shortage consumers have been substituting swamp taro, sweetpotato and rice.

Some consumers and agencies are averse to agricultural chemicals and want a “natural” product.

**Retailers and food service**

Most taro is sold fresh in wet markets and shops. Mining companies and the Regional Assistance Mission to Solomon Islands (RAMSI) usually purchase local taro. However, they require HAACP for the fresh and processed produce.

A distributor/retailer of local foods buys direct from growers provided they supply consistently and meet its quality standards.
Tonga

Taro production was 3,600t in 2010 (FAO). Taro is one of four leading export crops, with growers attracted by strong export demand, low input costs and good prices compared with other crops. Formal exports fluctuate, but fell to only 122t from 2005 – 9 (FAO).

Production

The leading cultivar, Taro Tarua, is very similar to Fiji’s Tausalo. Planting material is difficult to source, and currently being imported from New Zealand. Five larger exporting vegetable growers and co-operatives are allowed to import and sell inputs for production to growers to ensure availability. A tissue culture laboratory run by the Ministry of Agriculture, Food, Forestry and Fisheries (MAFFF) which supplied Fijian taro planting material to producers has been closed due to lack of the necessary expertise to run it. There are also other options for multiplication of planting material such as a Government laboratory being redeveloped in Tonga, tissue culture facilities in PNG, SPC in Fiji and a Korean aid-funded laboratory in Nadi.

Quality is inconsistent across the industry due to soil-borne pests and diseases, a lack of agronomy and extension support, and inadequate irrigation. During the visit most of the taro was drought-stressed, affecting shape and yield, and growers recalled that an old method of growing taro in dry conditions was to intercrop it in the coconut plantations for shade, but this is rarely now done. The main pest affecting production is taro beetle. Input costs such as fertiliser are prohibitively expensive for most small producers.

The industry is supported by the grower association GrowFed. Its export arm Growcom has a supply contract with a New Zealand importer. Collaboration is poor between GrowFed and MAFFF.

A High Temperature Forced Air (HFTA) treatment plant at Nuku’alofa airport suffers from irregular supply, and would function more effectively if supply across crops was more regular and co-ordinated.

Processors

Most processing only involves washing and trimming taro for export. There is minor production of frozen taro, and two crispmakers are using taro. The Taro Tarua variety produces a very good crisp, with less oxalate than other cultivars.

Noodles could be made from taro to substitute for imported wheat noodles, and there is interest in taro paste and new innovative products. There is a need to develop a processing manual and provide information on meeting HACCP standards for export.

Distribution

Quality is being affected by lack of a cool chain due to insufficient storage, poor washing practices, and poorly integrated supply chains.

Quarantine inspections in Australia and New Zealand have been finding seeds, rots and other prohibited content requiring costly disinfestation treatments such as fumigation, and even disposal. The import protocol requires cutting off the top (stem) but this causes the corm to rot while the eye can still grow.

Australia will not allow importation of small corm taro from any country unless it can satisfactorily demonstrate freedom from TLB, Colocasia bobone disease virus (CBDV), the French Polynesian strain of Dasheen Mosaic Virus (DMV), Taro vein chlorosis virus (TaVCV) and Tomato zonate spot virus (TZSV). This excludes most countries.
**Domestic consumers**

In Tonga there is a very high incidence of diabetes mellitus, with many people’s diet shifting towards imported wheat noodles. There is potential for taro to be promoted as a more suitable low GI food.

**Export markets**

Most exports are of fresh and frozen taro to expatriate Polynesians in Auckland and Sydney wanting traditional foods. Some frozen taro is also re-exported to California from New Zealand. Commercial channels supply the retail sector, often in competition with taro going through informal distribution channels from families in Tonga to relatives in New Zealand and Australia. Taro from these informal channels is usually distributed through churches and other Polynesian organisations. Commercial exporters also compete with highly competitive taro from Fiji, and profit margins are tight, especially in New Zealand. The lengthy supply chains to overseas markets are not providing any premium for quality of product or consistency of supply. While demand is strongest for taro from Samoa and Taveuni in Fiji, expatriate Tongans have no variety preference.

Most Tongan taro is sold in supermarkets as fresh product, with potential in New Zealand supermarkets for cut and frozen Taro Tanua and Giant Taro.

A large grower supplies small irregular quantities of Japanese taro (“Sato imo”) to Japan. As that market only accepts specific sizing he is seeking new markets, including Australia, for the other sizes.

Other growers are seeking opportunities for markets for undersized Taro Tanua taro and to understand the requirements of New Zealand restaurants for processed taro.

**Vanuatu**

Taro is an important rotational crop in Vanuatu for prevention of sweetpotato weevil.

Yields are affected by unsustainable production practices, with land being degraded through over-cultivation and farming of marginal land. Quality and yield are being reduced by soil borne disease and pests such as Taro beetle which is currently manageable but could be better controlled with chemicals. Numerous viruses have affected all taro cultivars.

Commercial production is mostly of the Nuie type. SPC manages the TaroGen collection, conducts taro research, and provides selected cultivars to growers. It sees a need to identify disease resistant varieties and promote them to growers. The Farm Support Association (FSA) provides extension to growers for organic and conventional production, but does not plan to commercially distribute planting material for root vegetables.

There is a small cottage processing industry manufacturing taro crisps, and interest in taro flour and noodles. Other potential products could be chilled and frozen taro, which may provide a market for beetle damaged taro. There is a lack of communication and sharing of resources by processors.

Distributors are often vertically integrated businesses that grow, process, distribute and export. Projects being proposed by distributors include supporting small Tanna growers to grow and process taro and ship it to Port Vila for export, and a collaboration with NGO ACTIV (Alternative Communities Trade in Vanuatu) and producers to grow taro, freeze it and export it to New Zealand.

Taro is sold fresh and as taro crisps in wet markets, retail stores, supermarkets, and hotel bars and shops. Some restaurants make taro french fries. Food retailers and tourist outlets require a
commercial standard of packaging that will maintain shelf life, but it is expensive to source. Hotels are increasingly requiring HACCP for fresh and processed products.

No exports are occurring, and while distributors perceive sufficient taro supply to allow exporting, refrigeration, sea freight costs and Vanuatu’s overvalued currency make it difficult to compete overseas.

**Kiribati**

Giant swamp taro (*Cyrtosperma chamissonis*), is a principal dietary food, and grown on a small scale for restaurants, with some agronomic information provided by the Ministry of Environment, Lands and Agricultural Development. The Ministry of Commerce, Industry and Cooperatives (MCIC) is trialling taro biscuits for import substitution, and other taro products. There are no exports.

**Cassava (Manihot esculenta)**

Cassava is an important staple crop in the Pacific Islands, including Fiji and Tonga. Production is increasing and in some areas replacing taro and yam. Cassava is grown as a staple for food security, with the roots often left unharvested until needed. It tolerates poor soils including sandy, eroded and overcropped, and is not prone to pests and disease.

**Fiji**

Production has grown steadily, reaching 51,690t in 2010 (FAO). Fiji Government plans to use cassava as the primary source for an ethanol industry that would require 500,000t of cassava a year.

**Production**

The industry will require assistance to improve its production systems and educate growers if an ethanol industry progresses. Cassava provides growers with very low margins. Distributors and retailers have difficulty sourcing consistent supply, with contract farming seen as an option.

**Processors**

Cassava has a short shelf life post-harvest, so is usually frozen for export by processors specialising in starchy staples. The roots are typically peeled, sliced, partially cooked and flash-frozen into 1kg and 2kg retail packs.

Cassava is also processed into cassava french fries, crisps, flour and grated cassava. Crisp-makers prefer pink-skinned and yellow cultivars such as Mandalay, and reject hard-to-peel types. While cassava flour is sought for bread-making, local cassava flour is costly to produce and uncompetitive against low-priced imported product. The local crisp market is also highly price-sensitive, with FJ$0.99 considered the price ceiling for a 45g packet of cassava crisps, so processors seek to lower costs to reduce retail prices to this level.

Current cultivars vary in levels of cyanide, which is unsafe to consume regularly. Cassava composition is sensitive to growing conditions, so the Facilitating
Agricultural Commodity Trade (FACT) project and USP have been investigating what environmental factors affect cyanide levels, and some manufacturers regularly have samples tested, including by USP’s commercial laboratory. A number of local varieties exceed FAO standards of 50ppm cyanide when processed into flour, and consumers prefer crisps from younger more tender cassava, so crisp-makers seek cassava harvested at five to six months when cyanide is lowest. However, growers expect a premium for early harvest and to be compensated for the reduced yields despite being able to sell two crops a year instead of one.

Cassava flour is also known to cause constipation in consumers so the Fiji Government is asking large processors to mix it with wheat flour.

The Ministry for Health enforces food safety standards and performs spot inspections and other checks. Growers supplying cassava with high levels of E. coli (Escherichia coli) have been dropped by manufacturers.

**Distribution**

Cassava is exported by a number of distributors specialising in starchy staples. Fresh cassava commands the highest prices but requires costly air freight due to short shelf life. Quality is being downgraded by poor post-harvest handling and logistics and an inadequate cool chain, with roots often damaged and blackened through lack of cool transport. Communication and co-ordination of supply along the chain is often poor. As a result export consignments have been failing overseas quarantine inspections, resulting in fumigation or disposal, that has seen some exporters switching from fresh to peeled and frozen cassava, which is a lower value product but carries lower risk, and can be sea-freighted.

**Local consumers**

Cassava is an important staple in Fiji, being a major source of carbohydrates. Consumption of local cassava crisps is growing and demand is strong. However, Fijians are price sensitive and reliable consumer research is needed to better understand attitudes to product attributes and price points.

**Retail and food service**

Fresh cassava is sold in stores and wet markets. Hotels and restaurants use it boiled, fried, in curry, in cake and as french fries. Hotel resorts serve baked cassava on theme night banquets for international tourists. Cassava crisps are sold in food stores, tourist shops and hotel bars, and served on Air Pacific flights. In hotel bars the crisps compete with catering packs of peanuts which are lower priced and easier to manage.

**Export markets**

Export is often through lengthy distribution channels of Pacific Islanders to export markets with the same consumer base. Fiji’s leading market is the United States, followed by New Zealand, Canada, Australia and Kiribati. Product is usually sold through Pacific Islander stores, but there is potential to expand into mainstream supermarkets. The US$58 million United States market is mainly American Latinos and expatriate Fijians and Fijian Indians buying frozen cassava. Small quantities of cassava crisps are also sent to Samoa.

**Kiribati**

A small quantity of cassava is grown commercially for restaurants only. Frozen cassava is being imported from Fiji.
Samoa
Cassava production is small but growing, with 460t in 2010 (FAO), mainly of a yellow-fleshed variety.

Cassava is not traditionally consumed in Samoa but used for animal feed, and the Samoa Farmers Committee is promoting it to feedmills. However, there are some small potential markets of Africans and other Pacific Islanders living in Samoa, and growing consumption of local cassava crisps.

Small processors produce cassava crisps and one is trialling cassava flour for use as a gluten free ingredient. A manufacturer is considering using local cassava to produce glue for packaging to replace imported wheat-based glue.

Cassava is sold in food stores and wet markets. Cassava crisps are retailed through supermarkets, food stores, hotels and airport shops.

There are no formal exports of cassava (FAO). Some cassava crisps are exported informally through family and friends visiting from Australia, New Zealand, Fiji, American Samoa and Hawaii. There are potential overseas markets for cassava flour as gluten-free flour.

Solomon Islands
Cassava production was 2200t in 2010, a fall of 12 per cent from 2006 levels (FAO).

Production
Cassava is intercropped with sweetpotato and other vegetables often in coconut plantations. While it is the second most popular vegetable with consumers, farmers prefer to grow sweetpotato because of its shorter growing time, higher yield per hectare and strong demand from restaurants and consumers.

The main variety is a tasty yellow flesh cultivar. Efforts by the Ministry of Agriculture to source cultivars suitable for export to Australia and New Zealand have been hampered by restrictions on importing planting material of root crops due to phytosanitary risks.

Processors
Small cottage processors in Honiara and outer island villages produce cassava crisps following training courses organised by the NGO Kastom Gaden in island villages. Kastom Gaden initially supported the processors as a marketing agent distributing the crisps through a bulk shop in Honiara but ceased due to inconsistent quality, variable weights of packs, lack of suitable packaging, and high inter-island freight costs to Honiara. Product ownership stages and payment scheduling caused much concern with village processors expecting immediate cash payment for all product sent, regardless of losses en route (e.g. breakages and pilfering).

A local power company is conducting distilling trials of cassava for biofuel for local and export markets.

Domestic consumers
Cassava is a leading staple food eaten in the home and approaching similar demand to sweetpotato, although consumption is increasingly shifting to rice. Fresh cassava is sold in wet markets and shops.
Local cassava crisps are growing in popularity, and sold in shops and cafés in Honiara and by grower/processors in their local villages and schools. While urban schools offer a potential market, a number of primary school authorities have restricted the foods sold within their compounds.

**Export markets**

Small irregular exports of cassava have included a small quantity of frozen product to Australia in 2008. A grower co-operative sees potential markets for fresh cassava in Australia, Kiribati and Nauru and for frozen cassava in New Zealand.

**Tonga**

Tonga has a small cassava industry, with production of 8200t in 2010, a decline of 14 per cent from 2006 levels (FAO). Cassava is considered by some to be Tonga's most important crop, particularly for export. Root crops provide a very good distribution of income along the supply chain in Tonga, but are low value. There is some vertical integration of production, processing and export.

**Production**

Production is dominated by a white cultivar grown for export and white-fleshed thin-skinned cultivars for local crisp manufacture.

The industry association Growcom and its export arm GrowFed match growers and processors with export opportunities, and the MAFFF provides export and technical support.

**Processors**

Cassava is frozen for export, but freezing facilities are generally inadequate, so a dedicated fast-freeze system is needed. Cassava is increasingly used to make crisps to supply a growing local market through retail shops and tourist. Other uses being explored include:

- A mixed bag of fresh cassava, taro and yam
- Cassava starch as an import replacement and an ingredient for ethanol, alcohol and glue
- Cassava flour and extruded cassava flour products
- Stockfeed

**Distribution**

The quality of fresh cassava is being affected by poor post-harvest handling, storage, transport, cool chain, packaging and lack of a post-harvest facility. It was suggested that a central packhouse would enable growers to pack their own containers.

Growers often use reefer shipping containers to cool their produce before delivering to the ship, making the reefer container unavailable for shipping use, to the frustration of the shipping companies. Delays in Pacific Islander importers overseas collecting consignments from the wharf are commonplace and affect product quality. Tongans traditionally store cassava underground, so MAFFF was intending to trial dipping in edible wax, as is done in the Caribbean, in an effort to extend shelf life by up to two months to enable export in dry containers and lower shipping costs.
Export markets

Exports of 696t in 2009 reflected a 20 per cent decline over the previous five years (FAO). The leading markets for fresh and frozen cassava are Polynesian and Melanesian expatriates in New Zealand, Australia and the United States. Cassava is usually exported frozen in 30kg bags, with the option of smaller packs.

Export markets for cassava are highly competitive, price-sensitive and low margin. Processors supply frozen cassava to export markets of consumers with low incomes, at tight margins, and in competition with good quality cassava from Fiji. Commercial distributors compete with numerous informal supply chains. Expatriate Pacific Islander importers want to pay the lowest price, and typically package cassava under their own brands. Some exporters use “onion sacks” which sit in containers until the Fijian importers collect them, affecting quality.

Vanuatu

Cassava is a small but growing cash crop. It is often grown in rotations with kava in traditional gardening systems to inhibit sweetpotato weevil buildup in the gardens. On Tanna some cassava is grown amongst coffee gardens.

Production

There is some variability in attributes across cultivars due to seed being collected for propagation – farmers select free seedlings and then take cuttings from them. Some distributors provide seeds to growers to multiply.

Wholesalers and crisp processors seek varieties that are easy to peel, less susceptible to bruising, and more consistent in key processing attributes than currently available. Processors prefer to buy from aggregators rather than from many individual growers. A distributor is proposing a vertically integrated project where small producers would grow yellow cassava on Tanna and the distributor would provide seed, distribution, processing and export.

Processors

Processed cassava products include french fries, cassava crisps, grated frozen cassava and cassava flour. Some cassava is frozen commercially for export, to overcome the short shelf life. A small manufacturer makes cassava flour for use in baking, extruded snacks and flour blends but has attracted little interest from the local baking, catering and food service sectors. Supplying supermarkets requires competing with lower priced imported cassava and wheat flour. Crisp-makers use locally sourced plastic packaging, but need commercial packaging to extend shelf life and meet retailers’ requirements.

Distribution

Wholesalers buy fresh cassava from small growers and clean and grade it for processors and export, but this is only viable from Port Vila due to high costs for refrigerated trucking and insufficient shipping services from other islands.

Fresh cassava quality suffers due to lack of suitable post-harvest systems and cool chain management, and failure to meet import requirements in export markets has resulted in substantial losses for exporters. As a result exporters have opted to ship lower valued frozen cassava, although freezing and freight costs and the overvalued Vanuatu currency result in low margins at best.
Retail and food service

Cassava is a staple food, but demand drops when prices rise. While hotels can easily source fresh cassava, tourists will only taste a sample.

Local cassava crisps are sold in supermarkets, hotel bars, tourist shops and at the Port Vila markets, and served to Air Vanuatu’s VIP passengers. Distributing to other Vanuatu islands is only feasible to Espiritu Santo due to poor inter-island shipping services.

To reach more of the growing tourist market, particularly passengers on international cruise liners, processors need to implement HACCP and adopt commercial packaging, but they lack the knowhow and local facilities required.

Export markets

There are no commercial exports of cassava, although in the past significant quantities have been shipped from Espiritu Santo to Sydney, packed under the importer’s brand. Export trials of frozen cassava to Australia have indicated a lack of competitiveness against lower priced Fijian product.

Processors see potential to supply frozen cassava from selected varieties to New Zealand, and cassava flour to New Zealand and other markets for use in gluten-free bakery products.

Yam (Dioscorea spp.)

Yam is an important staple crop in the Pacific Islands, mainly in Solomon Islands, Tonga and Samoa. Fresh intact yams can be stored for several months, contributing to food security. Only Tonga reported yam exports from 2005–9 (FAO). Production and harvesting are labour-intensive and crops are often affected by pests and diseases. There has been some shift in production from yam to cassava and sweetpotato, mainly in areas where labour is scarce, soil fertility is deteriorating, and pest and disease are affecting yields.

A European Union (EU) funded project established the South Pacific Yam Network in 1998 to promote yams for traditional cropping systems in Fiji, New Caledonia, Papua New Guinea, Solomon Islands and Vanuatu. The Network has investigated the characterisation and selection of yam cultivars for disease resistance (in particular anthracnose (Collettrichum gloeosporioides)) and commercial potential in the Pacific Islands. Varieties producing irregular shaped tubers are more difficult to harvest.

Fiji

In 2010 production was 1700t, a 34 percent decline from 2006 levels (FAO). Yams are usually peeled, sliced and frozen and packaged in retail packs for export. Opportunistic growers and strong market demand are resulting in fluctuating supply and pricing so some processors are moving into production to secure supply.

Exports of fresh and frozen yams are growing, mostly to Australia and New Zealand, and there is strong demand for frozen sliced yams from Kiribati, the United States and Canada. Exporters are having difficulty meeting United

![Fig. 9: Yams in Pacific Islander store, Australia](image-url)
States import requirements. FAO does not report yam exports from Fiji but fresh “Fiji” yams were seen in a Pacific Islander shop in Sydney in 2010.

**Kiribati**
No commercial production was identified, but yams are being imported from Fiji.

**Samoa**
Production of 4100t in 2010 represented 55 per cent growth over the previous five years (FAO). Yams were not handled by the companies interviewed.

**Solomon Islands**
Yam is an important crop, with production growing to 37,600t in 2010 (FAO). It is grown throughout the Solomon Islands intercropped with coconut and as a rotational crop. Production is seasonal, with harvest at nine months, and supply is reasonably consistent across wet and dry seasons. Kastom Gaden has identified good-tasting, high yielding varieties and successfully trialling them in other areas of the country.

Yam is a preferred vegetable for Solomon Islanders, although not widely promoted. Consumers pay a premium for quality yams, but baulk at SB$20 (AU$2.95) for a two to five kilogram yam.

A distributor who retails fresh yams in his Honiara local foods outlet buys directly from growers by the kilogram, grades on delivery, and insists on consistent quality.

Japanese and other yams could be exported by sea, given their good shelf life, with Australia considered to offer potential markets.

**Tonga**
Yam is an important staple food for Tongans and is one of Tonga’s four leading crops, with production of 5500t in 2006 (FAO). MAFFFS is building a new storage facility at the Nuku’alofa wharf for exporting yams and other crops.

Production is seasonal but supply is extended due to yam’s postharvest shelf life of two to three months. Distributors require longer shelf life for export so MAFFFS is trialling waxing of yams to allow them to be shipped in dry containers.

Exports have declined in recent years to only 85t in 2009, at an average price of AU$0.81/kg FOB (FAO). However, some producers are interested in pursuing opportunities for:

- sweet Japanese yam for the local market and export to Korea
- smaller sweet yams for the expatriate Polynesian market in New Zealand

**Vanuatu**
Yam is used in crop rotations to prevent sweetpotato weevil buildup, but is prone to some viruses. The Ministry for Agriculture is researching nutritional deficiencies in yams, and assists the Farm Support Association’s yam breeding program. Some yam growers are interested in exporting.
Breadfruit (Artocarpus altilis)

Breadfruit grows wild across the Pacific Islands, and is wild-harvested as needed. As it often grows from seed there are numerous varieties demonstrating a wide range of genetic diversity and variation in fruit attributes, which could be avoided through marcotting or multiplying from the shoot tip cuttings from young plants. Once ripened the shelf life is very short.

Pacific Islanders prefer to eat it as chunks.

**Fiji**

Breadfruit is a minor crop in Fiji. There is no commercial production and the trees grow mostly in the bush so wild-harvesting is labour intensive and costly, and most trees are left unharvested. As a result there is insufficient supply for processors and distributors to expand their domestic and export markets.

**Production**

Developing a breadfruit industry to increase supply will require well-managed commercial plantations using variety selection to ensure shorter trees and longer fruiting seasons. Some varieties fruit for up to nine months, others year-round. The Ministry of Primary Industries has been trialling new hybrids, including a Hawaiian variety, and longer season varieties, although Plant Variety Rights have made it difficult to access superior germplasm from the Hawaiian genetic collection. If trials are successful the Ministry could distribute planting material to local growers.

Fruit quality is being affected by poor handling and dropping when harvesting from tall trees, indicating a need to prune and improve harvest techniques. The extremely short shelf life once ripened requires a well managed cool chain. Market and processor requirements need to be assessed to guide variety selection.


**Processors**

Processors specialising in starchy staples produce peeled, diced, sliced or quartered, frozen and canned breadfruit. Consumers prefer small breadfruit for fresh consumption while processors seek large sizes to make frozen portions.

There are high transport costs from moving product from remote areas to processors. Efficient transporting between islands could extend the season of supply to processors and exporters. Australian breadfruit producers have been using modified atmosphere packaging to extend shelf life. Caribbean researchers have done a lot of work on shelf life.

Insufficient and unreliable supply and inconsistent quality have resulted in some processors ceasing using breadfruit. Wide variability affects crisp-making as a quality product requires high level of dryness at maturity, which only certain varieties provide. Selection and standardisation of cultivars is needed to enable market and processing development.

Short shelf life is also a major constraint, as it is difficult to deliver mature green fruit from outer islands to processors in Suva so that they can process it within a day. Many processors lack sufficient storage facilities to handle frozen breadfruit.
Processors expressed a need for information on how to process breadfruit, which is largely done by trial and error, including processing advances and finding a preservative that does not cause discolouration or affect taste. There is also shortage of suitable processing technologies. Local consultant Dr Richard Beyer has produced a number of publications on processing, which includes breadfruit. Processors need information to implement HACCP. There is a lack of local testing facilities for managing quality control such as laboratory analyses and testing of samples.

**Distribution**

A number of distributors handle breadfruit. One distributor/exporter has ample seasonal supply with well-managed postharvest handling, cool chain and quality control, and exports to Sydney and Melbourne. The fresh breadfruit arrives at the packing facility in crates and is repacked into cartons, with cushioning if needed, for heat treatment and export. However, training and improved handling are generally needed from picking and post-harvest onwards along the supply chain and cool chain to maintain quality and maximum shelf life.

**Retail and food service**

Fijians traditionally consume breadfruit boiled, fried or as juice in the home, and it can be used as a substitute for potato. Breadfruit is sold in wet markets but not by the leading retail chain due to lack of consistent supply.

Chefs in tourist hotels use small quantities of breadfruit for traditional theme nights, as tourists will taste but not consume in large quantities. Cooking breadfruit requires considerable cleaning and preparation, which can be managed in a fine dining restaurant with high meal prices and using minute quantities, but the average restaurant does not want to risk the customer rejecting it after all that labour.

**Export markets**

There is growing export demand for breadfruit in fresh form and as frozen pieces, canned pieces and straws, mainly for consumers from Pacific Island and Indian background. Exports are mainly as fresh breadfruit to New Zealand, frozen breadfruit to the United States, frozen and canned breadfruit to Australia, and vacuum packed to the United States and Kiribati. The Australian fresh market is supplied by a growing domestic industry and Australia only allows commercially produced peeled, seeded, and frozen breadfruit pulp to be imported as insufficient information is available on the risk status of fresh breadfruit.

New Zealand requires fruit fly disinfestation for fresh breadfruit, and growing quantities are being treated by Nature’s Way Co-operative’s heat treatment facility near Nadi Airport. While it is possible to supply the market with year-round frozen breadfruit, as it has a year’s shelf life, domestic distributors cannot afford to hold it in their freezers for long periods, therefore importers need to provide the storage.

The wholesale price for poor quality breadfruit seen in Brisbane was AU$4.00/kg in 2010.

**Kiribati**

Breadfruit and coconut are the leading tree crops in Kiribati. Breadfruit is available year-round from Fanning and Christmas Islands, from two varieties that fruit in alternative seasons. Most fruit is not harvested due to long distances to markets and lack of cool chain.

The Government supports industry development and is trialling breadfruit flour, breadfruit crisps, frozen breadfruit and fermented pulp for use in breadfruit biscuits. The Ministry of Environment
Lands and Agriculture Development – Kiribati (MELAD) has held breadfruit processing workshops with support from FACT.

While breadfruit is a principal staple, consumers are increasingly shifting to imported rice and wheat flour. The Kiribati Organic Farming Association (KOFA) is educating consumers on breadfruit’s food value and how to cook it, and proposes to increase usage with processed products.

There are thoughts of supplying Fiji processors using direct flights. This would require managing a cool chain to deliver mature green fruit that can be processed the same day. Constraints to export include long distances to overseas markets and lack of a domestic cool chain.

**Samoa**

Breadfruit grows wild across Samoa, and fruits regularly. Some is wild-harvested but most fruit is left on the trees.

**Production**

Some tree management has started, with trees being pruned to a practical height of around 15 feet, which makes harvesting easier and reduces damage from cyclones. Dropping fruit while picking tall unpruned trees bruises it and causes the sap to run into the flesh. This spoils the fruit, affects cooking and processing, and causes supply problems during the off season. Farmers are just beginning to understand about quality.

Current varieties are very good, although seedless cultivars need to be selected for commercial production and processing. While breadfruit has one season a year, fruit may be found year round as the fruiting season moves across the islands. However, processors generally find supply inadequate and inconsistent. They believe selection from a range of cultivars with varying seasons would enable year-round production and more consistent supply.

Breadfruit can be stored for two to three days if kept underwater. Samoans have traditionally used fermenting underground to preserve it for making breadfruit biscuits.

**Processors**

Processing of breadfruit is growing, particularly in crisp-making, but constrained by damaged and over-ripened fruit being supplied to processors. Processors will pay a premium for properly ripened fruit as they cannot use it green. Better quality management would reduce the current waste from unusable fruit. Processors need varieties with consistent attributes as variation across cultivars affects processing. There is a yellow fleshed type which has golden colour and good fragrance when cooked. Pou, the cultivar best suited to crisp-making, is available all year.

It is difficult to source crisp-making equipment suited to breadfruit, with processors adapting local equipment rather than risk importing technology that may not be suitable. They would like to source suitable processing equipment, particularly if it is second hand to reduce costs.

The supply of suitable ingredients such as cooking oils is also limited, and Samoa lacks the laboratory services needed for processors to control product quality.

Processors are seeking out other opportunities and trialling products such as frozen breadfruit, breadfruit biscuits and gluten free flour.
Domestic consumers

Breadfruit is a staple food, but consumption is relatively small as Samoans prefer to eat taro and bananas and increasingly imported rice. Breadfruit is always eaten cooked, often in coconut cream. Hotels and tourist shops sell local breadfruit crisps.

Export markets

The leading export markets for Samoan breadfruit are expatriate Samoans living in American Samoa, Fiji, Hawaii, Australia and New Zealand. As a fruit fly host breadfruit needs to be heat treated for export to New Zealand where market access has been negotiated. The Samoa Farmer Association has prioritised development of breadfruit exports, and proposes to engage with the Ministry on area-wide fruit fly control programs. The Government is seeking funding support for a HFTA plant, as the current facility which was designed for trials is too small for commercial quantities.

There are good informal markets for breadfruit crisps in American Samoa, Fiji, and Hawaii, often supplied by Samoan expatriates taking home product to sell in Australia and New Zealand. There may be a potential export market for breadfruit flour in Japan.

Solomon Islands

Breadfruit grows well in the Solomon Islands. An AusAID project has developed a plantation to promote breadfruit as a minor edible food for the Temotu region. The Temotu plantation was planted with varieties selected to be earlier-bearing and non-seasonal dwarf varieties so as to extend the harvest season. There is little interest from growers elsewhere. Fruit fly infestation affects yield and quality, so the Government is trialling a spraying program.

Some breadfruit is chopped and dried to make ‘nambo’ and sold in plastic bags as a popular snackfood in some Honiara and regional outlets. Distribution of fresh breadfruit is limited by lack of suitable transport and a cool chain. Kastom Gaden promotes growing and processing breadfruit, including training in crisp-making.

Lack of disinfestation facilities prevents exports of fresh breadfruit to potential markets in New Zealand.

Tonga

Breadfruit fruits from January to May, with wild-picking only. Many trees are not being harvested. There is oversupply during the season, which pushes down prices, and a lack of year-round supply for processing. Supply could be extended by selecting a mix of varieties with varied or longer fruiting seasons for commercial planting.

A number of factors affect fruit quality. Bruising occurs from poor harvest and handling techniques. Growers usually pack ten or more fruits of one to 1.5kg each into a basket for sale at wet markets. The short shelf life of mature fruit, estimated at one to three days if not refrigerated, requires a well managed cool chain.

Breadfruit has a lot of potential in the local market. Tongans like to eat breadfruit in chunks, and breadfruit wedges sold in cafes are also popular with expatriates. The good demand for frozen local breadfruit and breadfruit crisps, sold mainly in supermarkets, indicates potential to expand.
including exports. There are opportunities for chips and wedges as breadfruit is lighter than taro and cassava and may be more appealing to the tourist palate. Some processors have tried to process further but have inadequate technology, and the wide varietal variation affects processing. Supply is not adequate or consistent enough for processors to produce a frozen product for export. Technical support is needed to improve the quality of a blast frozen product. A lack of laboratory analytical services makes quality control difficult.

The Tongan Government is supporting export development for breadfruit. Export agencies buy and grade breadfruit and deliver it to the HFTA plant for regrading, packaging, fruit fly disinfestation treatment and air freight to New Zealand. Trials are being planned to better meet biosecurity standards in export markets while maintaining product quality through the heat process.

Vanuatu
Breadfruit is a seasonal crop, with great genetic diversity. It is a very popular staple in Vanuatu, but the traditional diet is shifting to low-priced imported carbohydrates from rice and wheat. Consumption of these imported starches is encouraged by schools and is altering the traditional diet.

Production
Breadfruit is grown in the traditional cropping system, and harvested for six months. It has a similar starch base to root crops and shares their post-harvest problems due to its short shelf life, so requires a well-managed cool chain.

Breadfruit is grown from seed so has great genetic diversity. Selection and standardisation are needed to enable the development of markets and processing. The Ministry of Agriculture is developing a collection of cultivars, including seedless types (triploids) from Western Samoa for greater ease of eating. In collaboration with the Ministry, FACT and FSA promote the growing of breadfruit and plan to collaborate with the Fiji industry to select shorter cultivars.

Processors
There is no local processing of breadfruit. Crisp production and trials of breadfruit flour, which require fresh breadfruit, are only feasible during the six month fruiting season. A proposed processing plant on Espiritu Santo intends to distribute processed breadfruit to other Vanuatu islands and overseas, but high costs of raw material and inter-island freight are likely to limit expansion.

Export markets
There are no exports. Exporting fresh breadfruit to key markets would require a fruit fly treatment facility. New Zealand’s expatriate Polynesian and Melanesian sectors offer a potential market for processed breadfruit.

Sweetpotato (Ipomoea batatas)
Sweetpotato is an important staple crop in the Pacific Islands, with the Solomon Islands, Tonga and Fiji the largest producers in the PARDI project countries. Production has declined, however, due in part to lower yields caused by insect pests, virus infections and inadequate soil nutrition.
A five per cent increase in regional production would produce 14,000t of sweetpotato for domestic consumption, and could replace AU$14 million in rice imports despite the convenience and low price that rice offers (ACIAR - yams, cassava and sweetpotato).

**Fiji**

Sweetpotato is a staple crop grown for local consumption only, with 7,464t grown commercially in 2010. The only imports of sweetpotato between 2006 and 2009 were one tonne (which may include processed product) at an average of AU$2.56/kg in 2006 and two tonnes averaging AU$5.12/kg in 2007. The most recently recorded exports of sweetpotato products were 14t (at an average AU$1.83/kg) in 2006 and seven tonnes averaging AU$6.22/kg in 2007 (FAO).

Sweetpotato is widely used as a rotational crop and a quick food crop following cyclones and tsunamis.

MPI is not promoting it to growers, and the industry situation is poorly understood. Growers prefer other cash crops due to sweetpotato’s comparatively low yield and pests and disease. Sweetpotato weevil ranks high as a pest, particularly in the drier regions of the country. However, a 50 per cent leap in production in 2010 after relatively stable quantities in the previous four years indicates that growers have begun to respond to strong market demand from retailers, distributors and processors who have all been looking for more supply.

**Production**

The leading colour groups are: 1) purple skin and white flesh; 2) purple skin and purple flesh; 3) white skin and purple flesh; and 4) yellow/orange flesh. Some poor quality product observed in wet markets suggests farmers may be having problems with some agronomic issues. Production and quality are affected mainly by sweetpotato weevil, sweetpotato flea beetle and diseases such as black rot (Ceratocystis fimbriata). The yellow fleshed varieties are more attractive to rats than other cultivars. Costs of farming inputs such as fertiliser are prohibitive for smallholder producers.

Discussion with retailers in the Suva market indicated sweetpotato is grown as a seasonal crop, harvested from late May/June.

**Processors**

Several processors have tried to make sweetpotato crisps and french fries for potential outlets such as a large retail chain, but cannot source sufficient supply of suitable fresh product and have to pay a premium to secure supply when needed.

Quality of sweetpotato crisps is inconsistent due to wide variation in processing attributes across cultivars and colour categories, and the fresh product being consolidated from a number of diverse growing regions. In particular, inconsistent sugar and dry matter content is leading to large batches being burnt and having to be discarded. Despite having adequate technology, processors have been unable to resolve problems with crisps browning during frying. The purple skin white fleshed type is usually used for sweetpotato chips, and Fiji has some very good yellow fleshed varieties that may process well, but more research needs to undertaken. A processor abandoned efforts to supply frozen yellow/orange sweetpotato to Korea when it could not resolve discolouration problems from processing.

A processor has found the yellow kumala gives good sweetpotato french fries similar to those served in New Zealand restaurants, indicating a market opportunity, although this would mean competing with low priced Chinese product. Other products with market potential are sweetpotato pulp and flour, frozen sweet products and babyfood products (from the yellow type).
**Distribution**

Distributors wanting to develop prospective markets are constrained by lack of supply of preferred colour categories and inconsistent quality from poor agronomy, post-harvest handling and lack of a cool chain. There is adequate white sweetpotato but limited supply of the orange fleshted type which delivers the highest prices.

**Retail and food service**

Sweetpotato of very variable quality is commonly sold in wet markets. The leading retail chain tries to carry locally grown sweetpotato and is able to source white and purple varieties but not an adequate and consistent supply of usable quality. The chain finds it difficult to procure the orange fleshted type. Discussion with small retailers in wet markets indicates that there is poor understanding of commercial demand for sweetpotato.

Sweetpotato is widely used in hotels and restaurants in numerous ways including baked, mashed, french fries and in cakes and salads. Restaurants prefer to use the orange varieties to provide colour. Hotels believe that tourists from Australia and New Zealand are more familiar with this type and prefer to serve it to them but the local orange fleshted variety is hard to source so some have resorted to imports.

Most local supply is of white types, which hotel guests will tolerate. However, product is often unusable due to internal blemishes such as black specks in the flesh (the cause needs further investigation) which Fijians may accept but tourists will not. Large hotels require quality and assured supply before they will replace imports of fresh sweetpotato (assumed to be from New Zealand) and frozen potato french fries.

There are indications that sweetpotato crisps could be sold in hotels, airlines and shops if there was adequate supply.

**Export markets**

Opportunities exist to supply fresh seasonal and frozen fries to New Zealand and frozen chips to Australia. The leaves, which are highly nutritious, are eaten locally and have export potential to countries that permit access (not Australia).

**Solomon Islands**

Sweetpotato is the leading staple crop. Annual production fluctuates, with 86,700t in 2009 (FAO), and occasional oversupply of local markets.

**Production**

Aid-funded projects have focused on increasing production and boosting yields. For example, ACIAR projects have introduced high yielding high carotene varieties and reintroduced promising Solomon Island varieties that have been pathogen tested. An EU project ‘Development of sustainable agriculture in the Pacific (DSAP)’ has also introduced high carotenoid varieties.

There is a high level of cultivar diversity, probably due to growers selecting natural crosses occurring in the field (ACIAR profile: Yams, cassava and sweetpotato). Projects to provide improved germplasm are continuing, and suppliers will want to bulk up and distribute planting material to growers.

Sweetpotato weevil (Cylas formicarius) is a major and long-term problem in dry periods, especially for imported cultivars such as Beauregard, and the Ministry for Agriculture has been trialling pheromones to combat infestations. White fly also affects some cultivars, often those with better...
flavour and sweetness, so the more resistant varieties often have a lower flavour profile. However, they can still be used for french fries.

ACIAR has funded the research project (PC 2006/106) ‘Screening and field trials of high carotenoid sweetpotatoes in Solomon Islands and Papua New Guinea to improve human vitamin A status’, which including testing of imported and local orange and yellow fleshed sweetpotato varieties for high beta-carotene levels. Another ACIAR project PC 2005/134 ‘The use of pathogen tested planting materials to improve sustainable sweetpotato production in Solomon Islands and Papua New Guinea’ has developed supply systems for sweetpotato planting material, and run farmer field schools and educated growers on production issues. As a result of these projects, growers are starting to buy pathogen tested cuttings rather than exchange potentially diseased planting material. As an ACIAR project (PC 2005/134) found sweetpotato weevil in semi-commercial areas, mainly in dry regions, there has been grower education in improved production techniques to identify and prevent weevil infestations.

**Processors**

There is very limited processing. An SPC project to support processing of sweetpotato crisps on a small scale to provide income for rural and remote areas has enabled a number of people at village level to produce the crisps for sale at local schools and markets. An attempt to consolidate and sell their products in Honiara was eventually abandoned due to issues of quality control, agreement of product ownership and timing of payments. There are also a couple of small processors making sweetpotato crisps for the Honiara market and having difficulty achieving commercial quality.

**Retail and food service**

There is reasonable continuity of supply despite distinct wet and dry seasons. Without market development, expanding production is likely to cause oversupply of local markets and reduce prices and returns to growers,

Distributors prefer to buy direct from local growers and encourage those located close to population centres. A Honiara wholesaler/retailer is insisting that supplying growers meet its quality standards. It buys by the kilogram rather than bulk, and grades on delivery at the shop. Some growers supply schools and shops directly.

Chinese restaurants and other cafes, restaurants and clubs make sweetpotato “local” french fries to serve with fish. These french fries provide a lower priced easy-to-peel alternative to the high-priced English potato.

**Kiribati**

There is minor smallholder production of sweetpotato. Some Tarawa households are growing it in their gardens under a Taiwanese Mission sponsored program. There is potential to replace imports, which were 30t in 2010, averaging AU$1.67/kg (FAO).

**Samoa**

Sweetpotato is grown mainly as a smallholder crop in Samoa. The Samoan Government is supporting variety improvement. A sweetpotato breeder at USP in Apia is bulking up around 20 varieties acquired through an SPC project to produce sufficient planting material for variety trials in drought and tsunami affected areas. Drought tolerance is amongst the qualities for assessment.

Sweetpotato is not popular with consumers, who often consider it overly sweet, and there is no obvious demand. However, wider availability may enable development of markets to supply other Pacific Islanders and Africans living in Samoa and the large diabetic population.
**Tonga**

Sweetpotato is a leading commodity crop with relatively stable production at 6,800t in 2010 (FAO), and can be harvested year-round. The main cultivar is a white skin purple fleshed variety known as ‘Hawaii’. There are also yellow fleshed varieties and a red skin white fleshed type known as ‘Papua’.

**Production**

The industry cannot meet market demand due to pests and diseases that affect production and yields. Growers can lose up to half their crop to weevil. Species *Cylas formicarius* weevil and West Indian weevil (*Eusepes postfaciatus*) have both been identified. Previous trial work done on pheromone lure trapping has not been continued. Sweetpotato weevil losses have on occasion forced growers to abandon sweetpotato crops.

Groundwater is scarce, and lack of water can cause crop stress. An old method of growing sweetpotato was to plant between the rows in coconut plantations, where it was believed the shading reduced crop water loss. Growers lack a source of clean planting material and feel there has been some yield decline. Government support for the sweetpotato industry includes selecting varieties suited to Tonga’s soil and climate conditions.

**Processors**

The main sweetpotato products are crisps and french fries. Some processors are trialling cultivars for frozen sweetpotato products for potential exports, including french fries to New Zealand.

**Domestic consumers**

Sweetpotato is a staple food and Tonga’s most popular and high-priced root crop, and widely used in hotels and restaurants.

If there was more supply the local and expatriate markets could be expanded through supermarkets. Sweetpotato also could be promoted as a low GI food, given Tonga’s very high incidences of diabetes and obesity.

**Export markets**

No exports are currently taken place (FAO). However, New Zealand offers a seasonal opportunity for fresh sweetpotato as well as french fries and other processed products.

**Vanuatu**

Sweetpotato is used in crop rotation systems, where it is planted after an initial taro or yam crop and followed by cassava and a fallow. This method, if well-managed, keeps the sweetpotato weevil population at a manageable level.

A larger producer has experienced minimal pest and disease problems with the main problem being small “borers” that appear when the soil dries out. He has been able to manage these through use of irrigation. He was using fertiliser to improve yields and had a crop rotation system in place. His male employees refused to care for sweetpotato, considering this to be “women’s work”.

A Ministry for Agriculture sweetpotato breeding program, which collaborates with grower groups, was concentrating on shelf life and organic carotene for baby food production.
Sugar levels vary considerably across the available cultivars, and variety selection aims for 68 per cent starch. This is neither too dry nor too sweet and suits the Vanuatu consumer’s preference for plain non-sweet staples. The orange variety is said to be nutritious when eaten raw.

Small processors make sweetpotato crisps, and restaurants produce french fries from sweetpotato. Some cultivars, including a bright orange type, are grown specifically for crisps and french fries. Constraints to processing include variable sugar content and texture across cultivars and insufficient supply of suitable varieties.

Vanuatu consumers eat sweetpotato every day and as french fries from cafes. They prefer varieties with red/orange flesh and white skin.

Best quality sweetpotato is sold at the Port Vila market at 500VT for a 5kg basket (AU$1.14/kg). The leading retail chain buys from local growers and is cost-conscious.

Sweetpotato’s maximum three weeks shelf life and Vanuatu’s shipping schedules do not suit fresh exports, but exports of chilled or frozen sweetpotato are possible.

**Potato (Solanum tuberosum)**

Potato is a minor crop in the Pacific islands, with most potato being imported to meet strong domestic demand.

**Fiji**

Production ranged from 70 to 80t a year from 2006 – 2010. Most of Fiji’s supply for this period came from around 18,000t a year of imported product (FAO). Import value fluctuated over this period but rose overall by 12 per cent, with imports to the value of AU$9.3 million in 2009 (FAO). Around half the imports are fresh potatoes from New Zealand during its August-December harvest, then from Australia, the remainder being mainly frozen french fries and wedges. The Government under its Import Substitution Program proposes to reduce these imports through supporting the development of a local industry in the Sigatoka Valley and elevated regions on Viti Levu, and through introducing a 40 per cent tariff on imported vegetables to press the food service industry into buying more local produce.

**Production**

Production is seasonal with the best planting times being late April through to early May. Potato growing is labour intensive and growers need further skills and equipment for expansion to compete with imported product. Yields are affected by several pests and diseases. In the past nematode infestations have been major concerns.

MPI trials in elevated areas of Viti Levu using imported seed of Red Rascal, Atlantic and Lady Rosette varieties have shown Red Rascal to have the best growth and acceptable results in processing trials.

Developing a local seed scheme could avoid relying on high priced imported seeds, enable local farmers to become seed producers, and reduce seasonal shortages of planting material.
**Processors**

Crispmakers prefer English potato to other root vegetables as it is highly homogeneous, manufactures well and gives consistent product at similar prices to taro and cassava. Processors need potatoes with uniform size, dry matter and high specific gravity, but are having difficulty with varieties coming from New Zealand, so have been substituting other root crops when supply is low in order to maintain production. A more consistent supply of potato could enable development of new products such as potato straws. A processor’s trial with Lady Rosette from New Zealand found it had the most uniform size and high dry matter, used less oil during processing and gave higher chip yield than other cultivars. Red Rascal was able to be processed also, but most varieties they trialled were more suited to the fresh market. The Atlantic variety showed very low specific gravities and processed poorly in the trial. As this is a popular crisping variety throughout the world further investigation may be warranted.

**Retailers and food service**

Imported potatoes are widely sold in shops and wet markets. Most local potato crisps are sold in shops at double the price of imported crisps which retail at around FJ$0.99 a bag, reflecting the higher costs of using imported potato.

Much of the imported processed product is used by hotels who assume Australia and New Zealand visitors expect french fries and wedges, especially in children’s meals.

**Kiribati**

There is no commercial production of potatoes. Annual potato imports fluctuate, with 39t valued at $65,000 in 2009 (FAO).

**Samoa**

There is no commercial production of potatoes. Imports grew 23 per cent from 2005 to reach 1,034t in 2009 with an import value of AU$437,000 (FAO).

Shops sell many brands of imported potato crisps and frozen potato products.

**Solomon Islands**

There is no commercial production, and varying quantities of annual imports, with 73t in 2009 valued at AU$43,000 (FAO). Imports include potato products for expatriate workforces such as mining projects and the RAMSI peace-keeping force.

Cottage processors use potatoes and other root crops to make crisps for local food outlets. Restaurants and cafes offer both “french fries” from English potato and “local french fries” from sweetpotato.

**Tonga**

A very small domestic industry grows potato for the local fresh market. Annual imports vary, with 164t in 2009, valued at AU$43,000 (FAO).

Dryland potato crops are difficult to grow in the Tongan summer, which is the dry season. There is limited water available for irrigation which allows some growers to irrigate their crops but it is believed that the water supply is not sufficient for all to irrigate. There is a need to investigate and develop agronomic systems and packages such as intercropping with coconut for shade.
Varieties grown include Red Rascal, Desiree, Rua and Pontiac. There is no local seed supply so potato growers have to use certified seed from Australia and New Zealand.

Potato is a preferred root vegetable for locals and the small expatriate community. Hotels, restaurants and retailers also offer imported frozen potato products. There was interest in exporting to Fiji but it proved unviable against imported potato from New Zealand.

**Vanuatu**

There is a small potato industry, primarily on the main island of Efate to supply Port Vila. Cooler areas such as Tanna Island are better suited to potato-growing but with current shipping services and storage facilities it is not feasible to supply the main market of Port Vila.

Pests and diseases have been severely reducing crop yields. Production is also constrained by lack of local seed supply, and there is concern about risk of disease from imported seed, some believing this to have occurred in the past.

Potato is in demand from consumers and visitors. Local retailers sell imported fresh and frozen potato products. When available hotels will use local potatoes, including as crisps and french fries.
6. Research findings – other crops

Duruka (Saccharum edule)

Fiji

Duruka (also known as “Fiji asparagus”) is a popular crop in Fiji. A relative of sugar cane, it is a low maintenance crop, can be harvested for four years from maturity, and provides good returns to growers, processors and exporters. It was felt that expanding production will require agronomic support and training for growers.

Vegetable processors who produce frozen duruka stems for export are interested in contracting growers to assure supply.

Due to the short four week harvest season there is interest in identifying cultivars with longer harvest periods, and distributors are installing warehouses to extend the period of supply.

Consumption in Fiji has been growing strongly. The stems are used in curries and other savoury dishes as they absorb flavours well. Duruka is sold in local markets and by roadside vendors. A hotel resort interviewed has duruka on the menu and is considering freezing it for year-round use.

Exports have been growing to meet strong demand for use in Indian curry and Asian meals in Australia and New Zealand.

Ginger (Zingiber officinale)

Fiji

Ginger production was 2,338t in 2010, a fall of 27 per cent from 2006 levels. Annual imports ranged from 10 to 137t between 2005 and 2009, with 67t from Australia, China and India valued at AU$206,000 in 2009, averaging AU$0.33/kg. From 2005 – 9 exports fell by 26 per cent, to 1037t at an average AU$4.04/kg FOB in 2009, to Australia, New Zealand, Europe and the United States (FAO).

Three processors, some handling other root crops, produce peeled ginger in brine or frozen ginger. A subsidiary of Queensland company Buderim Ginger sends ginger in brine to the parent company for processing. Other processors send ginger in brine and frozen ginger to Sydney for use in restaurants, bakeries and other outlets.

The industry lost its United States market in recent years due to intense price-based competition from China after Japan tightened its import standards for chemical residues. As the United States was now increasing its own scrutiny of Chinese vegetable imports it was hoped that the Chinese industry might refocus on the Japanese market, thereby relaxing the price pressure and allowing Fiji exporters to return to the United States.
Solomon Islands
There is minor ginger production. Kastom Gaden is working with a processor under its Farmer Fresh project to encourage producers to grow ginger for the domestic market.

Vanuatu
Both the “curry” type of ginger (thin with intense flavour) and the thicker fatter Chinese type are grown in Vanuatu. The NGO Syndicat Agricole is interested in establishing a ginger industry to target the Australian market.

A processor of ginger has supplied ginger in brine to Buderim Ginger for crystallising, and certified organic baby ginger to Italy. There is a potential market in New Zealand, and growers have received training on its import protocol for ginger.

Other vegetables

Fiji
A wide range of vegetables are produced, including tomatoes, eggplant, okra, capsicum, chilli and herbs, with overall production generally stable (Table 2), although there has been some change in production regions due to some farmers shifting to taro. Tomato output has grown in recent years, including new hydroponics production.

Production volumes are insufficient to meet demand so significant quantities of vegetables are imported (Table 2). Under the Import Substitution Program the Government has been proposing to reduce annual food imports of around FJ$450 million (AU$257 million) by introducing a 40 per cent tariff on imported food for hotels, so the Hotel Association has been working with the Ministry for Agriculture to improve local purchasing and supply.

Table 2: Production and trade of European vegetables in Fiji, 2005-9

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Production</th>
<th>Imports</th>
<th>Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eggplants (aubergines)</td>
<td>3,700 0%</td>
<td>0</td>
<td>225 2%</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>3,500 25%</td>
<td>95 45%</td>
<td>0</td>
</tr>
<tr>
<td>Pumpkins, squash and gourds</td>
<td>1,900 -5%</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cucumbers and gherkins</td>
<td>1,200 0%</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Okra</td>
<td>1,000 -5%</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Green chillies and peppers</td>
<td>800 -26%</td>
<td>405 36%</td>
<td>2</td>
</tr>
<tr>
<td>Cabbages and other brassicas</td>
<td>750 0%</td>
<td>99 47%</td>
<td>67 21%</td>
</tr>
<tr>
<td>Vegetables fresh, not specified elsewhere</td>
<td>8,500 0%</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cauliflowers and broccoli</td>
<td>65 47%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Frozen sweet corn</td>
<td>31 3%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Leeks and other alliaceous vegetables</td>
<td>16 59%</td>
<td>1 n/a</td>
<td>0</td>
</tr>
<tr>
<td>Green peas</td>
<td>5 98%</td>
<td>21 2%</td>
<td></td>
</tr>
<tr>
<td>Spinach</td>
<td>3 50%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Green beans</td>
<td>1 75%</td>
<td>23 16%</td>
<td></td>
</tr>
</tbody>
</table>
Production

Production is characterised by small-holding farming. Seeds and seedlings are sold through farm supplies outlets and a retail chain. The Government restricts certain seeds and seedlings to avoid introducing pests and diseases. Farmer education is an issue, with farming often left to those with limited education and training. Chinese immigrants are involved in vegetable production, mostly using small-landholding farming techniques as used in their homeland. There are concerns that these Chinese market gardeners are buying unapproved agricultural chemicals from local shops. This is particularly important as residues may be found in exports, which go to Australia, New Zealand and Canada.

Growers, mainly those involved in smallholder/low level commercial farming, often lack planting material, equipment and other inputs (fertiliser, fungicide, insecticide etc.), as well as storage and distribution facilities. Processors and retailers often complain of inconsistent and unpredictable supply. Growers do not deliver as agreed, fail to supply agreed quantities as scheduled, and do not provide consistent quality. As a consequence, one distributor has sponsored overseas workers to work in vegetable production.

Taro growers from Taveuni are interested in growing vegetables for the small local hotel and retail trade to replace product shipped from Viti Levu. To be successful the growers need assistance such as accessing a supply of seedlings, development of a local nursery, agri-supplies, agronomic expertise and market intelligence.

A wholesaler-retailer has begun producing and distributing hydroponic capsicum, cucumber, herbs, iceberg lettuce, truss tomatoes and zucchini using its own farms and contract growers. The company also plans to build and sell screenhouses and greenhouses to enable protected vegetable cropping during the wet season. There is some interest in encouraging growers to use greenhouses for higher value vegetables such as cauliflowers and capscicum.

There is small-scale organic growing of vegetables. However, the growers involved find it difficult to obtain organic certification under the current recognised schemes. Limited supply of seed means growers are often farming pest and disease susceptible varieties.

Some vertically integrated producers grow specifically for export to Australia and New Zealand, and send weekly air freight consignments to Kiribati, Nauru and Tuvalu. The largest exporter provides extension and export accreditation support to its supplying producers. These businesses also supply vegetables to McDonalds, hotels, airlines, the military and hospitals.

Processors

Some processors buy from dedicated regions with contract planting and purchasing of crops at harvest. Intermediaries also arrange contract planting, and buy and deliver for the processors. Larger processors conduct their own grading and regular quality and quarantine checks.

Some vegetables such as eggplant and drumstick (Moringa oleifera) are frozen for export. There is potential to freeze other vegetables such as beans, broccoli and cauliflower, and to process beans for salad mixes, mainly for export. A local processor makes chilli and tomato sauce from imported ingredients, and could process Bongo chilli (a local chilli) given sufficient supply.

Traceability systems and country of origin on food labels are not yet required, but some manufacturers involved in exports have been implementing HACCP. There are concerns that vegetables are grown with fertilizers and insecticides that do not meet world health standards. It was also reported that some imported products are said to have fake labels.
Due to poor road conditions (especially in the wet season) and lack of containerisation, product is being lost when trucking from farms to the processors.

**Retailers and food service**

European and Asian vegetables are sold in wet markets and shops, and there are opportunities to ship fresh vegetables such as snowpeas and beans to outer islands. The leading retail chain buys vegetables locally but has difficulty obtaining reliable local supply, and also imports substantial quantities from New Zealand. It was planning to implement HACCP.

Indicative prices for local produce at retail level are tomatoes at FJ$21.00 (AU$12.00)/kg and iceberg lettuce at FJ$15.00 – 16.00 (AU$8.60 – 9.15)/kg.

The hotel industry could buy locally up to 35 per cent of its supply needs, given the right supply and quality parameters. For example, one large resort hotel buys around FJ$3,000 (AU$1,715) of imported fruit and vegetables a week. The resort would gladly use more local quality produce, especially lettuce and cherry tomatoes, but cannot source consistent supply. Some products are not available at all in Fiji, such as sweetcorn and Roma tomatoes. The hotel industry is often competing for supplies with exporters of first-grade produce. Hotels and resorts will pay premium prices for quality product that is properly cleaned, handled and packaged to meet hygiene standards.

Some hotels have greenhouses or kitchen gardens growing frequently used produce such as lettuce and herbs. Hotels also plan to improve local supply by supporting organic growers and hiring contract growers. One hotel is proposing to run an organic farm to be certified under the new Pacific Organic Standard.

**Export markets**

Vegetable exports to Australia and New Zealand include fresh eggplant, peas, chillies, okra, herbs and frozen cluster bean. Producers would like to send organic capsicum to New Zealand but no protocol is in place.

Sea freight of small shipments costs FJ$0.73/kg plus a surcharge, while large exporters receive discounted rates for volume.

**Kiribati**

There is minor production of non-root vegetables, and some imports, mainly brassicas (Table 3).

**Table 3: Imports of European vegetables to Kiribati, 2005-9**

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Import volume 2009 (t)</th>
<th>5 year growth in import volumes (2005-9)</th>
<th>Import value 2009 (AUS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cabbages and other brassicas</td>
<td>35</td>
<td>3%</td>
<td>49,938</td>
</tr>
<tr>
<td>Cauliflowers and broccoli</td>
<td>0</td>
<td></td>
<td>1,280</td>
</tr>
<tr>
<td>Green chillies and peppers</td>
<td>5</td>
<td>400%</td>
<td>12,805</td>
</tr>
<tr>
<td>Lettuce and chicory</td>
<td>0</td>
<td></td>
<td>1,280</td>
</tr>
<tr>
<td>Frozen sweet corn</td>
<td>0</td>
<td></td>
<td>1,280</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>1</td>
<td>-67%</td>
<td>3,841</td>
</tr>
</tbody>
</table>

Source: FAO
Members of the Kiribati Organic Farmers Association (KOFA) on Tarawa are engaged in small-scale vegetable growing, and consider organic farming and certification to be feasible as the Kiribati Government has ceased chemical imports and chemical usage is already low. KOFA has enlisted assistance from the FACT program to enable organic production to meet the Pacific Organic Standard.

There are no agricultural supply shops in Kiribati, but the Taiwan Technical Mission provides free hybrid vegetable seeds. KOFA wants to make producers more self-reliant by establishing a commercial seed operation for open-pollinated vegetables.

Bringing produce from outer islands is difficult due to poor logistics.

**Samoa**

There is a small vegetable industry, supported by the Samoa Farmers Association, the Ministry of Agriculture and Fisheries and SPC. The FAO reports only small and declining quantities of tomato imports, with nine tonnes in 2009 valued at AU$37,000.

Growers find it difficult to access sufficient planting material from farm supplies outlets to plant a crop when conditions are ready. Organic fertilisers available from Australia have not proven very suitable for vegetables. Vegetable crops are prone to high levels of pests and disease, but growers lack knowledge of how to handle them.

Local vegetables are sold in the Apia wet market and a few specialist vegetable growers supply hospitals, hotels and restaurants, but manufacturers rely mainly on imported vegetables.

Small quantities of pumpkin and other vegetables are exported to American Samoa.

**Solomon Islands**

There is substantial local production of vegetables. Minor imports (Table 4) are from Australia, and mostly of varieties such as Roma tomatoes for hotels where seed is not available locally. The Government has agriculture as a high priority and has developed MOUs for collaboration with local NGOs, but is limited with manpower and finances.

### Table 4: Imports of European vegetables to Solomon Islands, 2005 – 9

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Import volume (t) 2009</th>
<th>5 year growth in import volumes 2005-9</th>
<th>Value (AU$) 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green beans</td>
<td>3</td>
<td>n/a</td>
<td>2,561</td>
</tr>
<tr>
<td>Cabbages and other brassicas</td>
<td>4</td>
<td>-20%</td>
<td>7,683</td>
</tr>
<tr>
<td>Cauliflowers and broccoli</td>
<td>3</td>
<td>50%</td>
<td>8,963</td>
</tr>
<tr>
<td>Lettuce and chicory</td>
<td>1</td>
<td>n/a</td>
<td>2,561</td>
</tr>
<tr>
<td>Green peas</td>
<td>4</td>
<td>300%</td>
<td>7,683</td>
</tr>
<tr>
<td>Frozen sweet corn</td>
<td>1</td>
<td>-67%</td>
<td>3,841</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>1</td>
<td>-83%</td>
<td>3,841</td>
</tr>
</tbody>
</table>

Source: FAO

**Production**

Production is typically smallholder farming rather than large scale commercial production. Growers mainly grow for their household and sell any surplus when cash is needed. Producers have minimal business skills. They usually plant from what they see is popular or scarce in the market, which results in periods of gluts followed by scarcity in supply, and if the market is oversupplied
growers usually wait for a shortage before replanting. Kastom Gaden would like to see farmers undertaking crop planning. As radio is widely used by farmers, Commodities Export Marketing Authority (CEMA) and the Ministry for Agriculture and Livestock (MAL) provide weekly fresh produce prices.

Environmental issues such as excessive rain and floods can create shortages, as vegetables such as broccoli, cabbage and carrots grow better in the highlands and need to be transported to Honiara. There are difficulties growing crops such as lettuce during the wet season from January to March so there is some investigation into growing under protected conditions.

Lack of suitable supply of vegetable seeds is a major constraint. Retailers tend to either sell imported large commercial packs, which small growers cannot afford and which have more seed than is required, or household packets which are too small. Varietal selection is also limited. Seed storage moisture control is a major issue affecting seed viability. Most seeds are not available in the provinces. Growers prefer open-pollinated seeds to enable them to secure seed when it is scarce but farm supplies outlets do not sell them. The only commercial seeds observed on the visit were from China, with Chinese labels.

An AVRDC-The World Vegetable Centre project has been aiming to provide better adapted seeds and implement seed multiplication to overcome the difficulty of buying commercial seed. It promotes open-pollinated varieties selected by the growers on taste and ease of growing, and has run commercial trials with small growers around Honiara. Despite these efforts seeds must continue to be imported due to lack of suitable storage facilities and knowledge in seed production.

Kastom Gaden is also addressing the lack of planting material with a number of projects. Having identified some fruits and vegetables best suited to local conditions, it produces seed of open-pollinated varieties at its Honiara farm, and has developed a seedbank of 150-200 accessions, with usually five to six varieties of each plant type. Kastom Gaden distributes these seeds at village level and trains growers in seed-saving to maintain supply and to encourage seed-sharing. It has linked up with Farmset Ltd, a farm supplies store. Kastom Gaden hopes to encourage the development of professional seed producers to increase supply, with Farmset buying their seeds to package and sell in its stores. Kastom Garden encourages refrigeration to maintain seed germination, but needs to source better packaging materials such as foil packs.

PDL Toll (now known as Toll Remote Logistics) has attempted to motivate producers to grow vegetables for the Goldridge mine workforce and expatriate markets by providing seeds. This has not been successful, with supply lapsing after a few weeks. They have not been able ascertain why supply did not continue.

Pests and disease and soil management are major problems for producers, particularly as some farmers are moving from traditional farming systems to modern monocrop systems with reduced crop rotations/fallows. There is concern that agricultural chemicals are usually only sold in large quantities and growers are using them with minimal knowledge.

An AVRDC -World Vegetable Centre and AusAID project, in partnership with Kastom Gaden, Farmset, MAL and a local women’s NGO, sought to improve the quality of production and support vegetable growers in Malaita, Makira and Guadalcanal. The target vegetables were tomatoes, eggplant, yardlong beans, peppers, pak choy and onions. The project has included trialling netting of vegetables for insects on commercial farms and implementing Integrated Crop Management (ICM) technologies such as netting and drip irrigation. Other areas include capacity building through training on composting, integrated pest management, marketing; and a weekly survey of market demand and prices. Training for women, who have the responsibility for household farming, has also been undertaken.
To meet consumer preferences for organically grown foods, growers sell vegetables as uncertified organic direct to local wet markets and buyers. Kastom Gaden sells its members’ vegetables as organic, but as they may also buy produce from the market when required to meet orders they cannot be certain about all the growers’ farming practices. The Participatory Guarantee Scheme (PGS), based on the Pacific Organic Standard, offers an alternative to organic certification bodies of Australia or New Zealand.

It was observed that that 40 per cent of Honiara’s large waste output is organic and could be composted and recycled back to farmers as organic fertiliser.

Market requirement specifications for produce need to be evaluated. Producers usually supply direct to hotels and restaurants. There are also efforts by AVRDC –The World Vegetable Centre to engage with growers’ groups to supply to the restaurant trade.

**Processing**

There have been some aid-funded workshops with processors from Fiji and Vanuatu. Trials of wet and dry processed products have had few commercial results, with most participants reluctant to move to further processing. A Kastom Gaden project to have product processed on remote islands and shipped to Honiara for packaging failed, mainly due to product quality variation, packaging issues and lack of transport.

There are some very small processors, who are having problems growing their businesses. For example, a small business is developing a range of dried fruits, muesli and vegetable products, with strong interest from food service operators. However, it uses borrowed small-scale equipment and struggles to finance the operation. The processor must pay growers in cash for their supply but waits for more than a month for payment from customers. It has access to local label designers but no local supplier of commercial packaging so has to focus on bulk outlets rather than retail.

**Distribution**

There is a lack of central distribution for fruit and vegetables and no real middlemen. In the Honiara market most women buy product to package and resell. Families often take pineapple and cabbage to the market to sell directly rather than using a middleman. To bring produce from outer islands the grower travels with the load then finds a vehicle to drive it to the market, and stays there for up to five days to do the selling. There is some informal consolidation, with small-scale distributors buying from the market and selling to businesses and other resellers. There may be a need for a wholesale fresh produce market. Some believe that there are many cultural issues affecting commercial development, such as jealousy and rivalry.

The Honiara wet market does not provide cool storage or storage areas with good airflow for vegetables. There is also a real need for quality training, cool chain logistics and postharvest storage.

From its network of 2000 members Kastom Gaden supports lead farmers who want to access the Honiara market. Producers are scattered, and for those on Guadalcanal transport is often on the back of trucks in rice sacks. The transport system in the Solomon Islands is generally expensive, inadequate, uncoordinated and unreliable. Infrastructure is poor, and bridges are continually washing out and take a long time to repair. Shipping is privately owned and there is considerable variation to schedules. Generally it is not cost effective for Solomon Islanders to utilise these services for fruit and vegetable transportation. As a result most production is concentrated on Guadalcanal and its neighbouring islands.

Kastom Gaden’s distribution arm Farmfresh makes home deliveries of fruit and vegetables to support grower members. If produce is of good quality deliveries are also made to expatriates.
usually single professionals who resist shopping in the wet market. There is also an opportunity to target local high income earners. However, lack of commercial transport is a major constraint.

A distributor is encouraging producers to trial growing chilli and ginger for the domestic market and build their practices there before targeting export markets. In the past export trials have been unviable.

**Local consumers**

John Tutua, the founder of Kastom Gaden, promoted “buy local, eat local”. His *Supsup Garden* program has been very effective, providing education on home gardening. However, there is a growing demand for rice which is taking over from traditional staples in the local diet.

There is an expatriate population that is growing, with more than 600 expatriates, some from Chinese and Filipinos backgrounds.

Consumers are suspicious about chemical use in vegetables and tend to over-clean them. They are aware of growers’ lack of or minimal education in chemical use and that DDT dumps are still being cleaned up, and increasingly demand “natural” product grown without chemicals. Consumers accept the statement “Grown to organic standards” although they know that formal accredited organic programs are not being followed.

**Retail, food service**

Farmers often sell their own surplus vegetables in wet markets. The largest market, in Honiara, is not accessible to outer islands or able to absorb all their produce.

Supermarkets and Chinese stores are significant vegetable outlets. Expatriates buy imported fresh produce from supermarkets. AusFresh imports vegetables from Australia for its own shop in Honiara.

There is a lack of information on produce required by the restaurant and hotel trade. Supply is also inconsistent and of varied quality. Kastom Garden wants farmers to develop better planning skills and has also tried to connect farmers to hotels wishing to source locally. Chefs have visited the farms and in some cases provided seeds such as herbs for specialised produce used in their menus. However, poor price margins from hotels provide no financial incentive to the growers.

RAMSI import all fruit and vegetables to avoid artificially inflating food prices as there is not enough supply to supply both locals and expatriates. All produce used by RAMSI is required to meet Australian quality standards such as HACCP. The import contract was held by HK Logistics (HKL) at the time of visit.

PDL Toll, in the Solomon Islands since 2005, was supplying the Goldridge mining project and its 500 staff at the time of visit. While much of the fruit and vegetables they supply are imported, the company wants to source local food, both for freshness and to foster goodwill. However, they have found it difficult to source local vegetables, particularly during the wet season. Transport is expensive, so the company is always seeking more efficient shipping. It has been using a two-to-three week shipping cycle of Brisbane-Port Moresby-Lae-Honiara-Brisbane. There is also a PDL Toll Priority’s 737 air freighter every Thursday between Brisbane and Honiara.

Mining companies, RAMSI and tourist outlets could replace vegetable imports with locally produce. However, producers generally have little awareness of such opportunities or are unable to provide a suitable HACCP program. Tendering for catering contracts such as hospitals and colleges is highly competitive.
Tonga

There is substantial production of vegetables, including zucchini, onion, Asian leafy vegetables and kabocha pumpkin, and a grower is investigating the potential of mushrooms. However, production is seasonal, with many vegetables imported during the wet season from January to May, when local quality is low and prices highest (Table 5). A processor proposes to grow hydroponic salad vegetables for hotels, and seasonal tomatoes. The Ministry of Agriculture has been encouraging home food production to boost food security.

Table 5: Trade in European vegetables, Tonga, 2005-9

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Imports</th>
<th></th>
<th>Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Volume (t)</td>
<td>5 year growth in volume 2005-9</td>
<td>Value in 2009 (AUS)</td>
</tr>
<tr>
<td>Cabbages and other brassicas</td>
<td>-</td>
<td>-</td>
<td>20</td>
</tr>
<tr>
<td>Cauliflowers and broccoli</td>
<td>-</td>
<td>n/a</td>
<td>2,561</td>
</tr>
<tr>
<td>Green chillies and peppers</td>
<td>1</td>
<td>0%</td>
<td>1,280</td>
</tr>
<tr>
<td>Leeks and other alliaceous veg</td>
<td>7</td>
<td>17%</td>
<td>10,244</td>
</tr>
<tr>
<td>Green peas</td>
<td>4</td>
<td>n/a</td>
<td>10,244</td>
</tr>
<tr>
<td>Pumpkins, squash and gourds</td>
<td>-</td>
<td>-</td>
<td>915</td>
</tr>
<tr>
<td>Frozen sweet corn</td>
<td>10</td>
<td>67%</td>
<td>1,280</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>-</td>
<td>n/a</td>
<td>3,841</td>
</tr>
</tbody>
</table>

Source: FAO

Production

Vegetable producers range from smallholder growers to relatively large farms supplying export markets (mainly kabocha pumpkin to north Asia).

Recent environmental change is seen as a major constraint to increasing production, particularly if current seasonal patterns remain.

Growers are supported by GrowFed (which focuses on regional development), its export arm GrowCom, the Friendly Islands Marketing Cooperative (FIMCO), the Ministry of Agriculture and Food, Forests and Fisheries (MAFFF) and the Department of Trade and Commerce, although the organisations agree that there is a lack of communication, co-operation and information on market opportunities.

Lack of timely seed supply is a major issue. Farmers lack the finance to buy planting material, and local production by growers is ad hoc and inadequate. Some planting material is supplied from a MAFFF nursery and tissue culture facility; GrowFed, who import seed for its members from New Zealand and Asia via Fiji; FIMCO; a FACT project providing seedlings to growers; and four growers licensed to import seed.

There are no large companies importing agricultural supplies. Inputs are supplied by small stores and by the same grower/importers who are also licensed to directly import chemicals.

Larger grower/exporters see a decline in overall vegetable quality from inconsistent products, poor post harvest management and the effects of cyclones and drought. While some larger growers
irrigate, most water using only buckets so crops are often stressed. There is concern that expanding production will exacerbate already falling water tables, and that more sustainable production systems are needed to better manage inputs to improve yields.

**Processing**

There is some small scale processing, but further development is constrained by lack of adequate supply. There is a lack of nutritional analysis services and access to recognised food analysis laboratories. Packaging and understanding of labelling requirements are poor.

A company is successfully manufacturing and commercialising chilli paste. Other opportunities include: tomato ketchup, pickling for the local market, and papaya pieces.

**Retail and food service**

Most local produce is sold in wet markets on weekends. Generally vegetables sold in supermarkets in the wet season are from New Zealand, as local produce is scarce, poor quality and high priced. Chinese retailers own most small stores, with four groups dominating food retail and imports.

The food service trade cannot be supplied by local production alone, and there is a lack of formal distribution, so large hotels generally use imported fresh produce. There are plans to produce hydroponic salad vegetables for hotels, and seasonal tomatoes.

**Export markets**

The vegetable industry is very export-focussed.

Exports have been mainly of Kabocha pumpkin (Japanese squash) to Japan and Korea, but export volumes have fallen, freight costs are increasing, and competition is growing in Tonga's supply season, while prices have stabilised. There is potential to develop markets in Korea and China for processing grade squash that is outside Japanese market specifications, although exports are constrained by unreliable power supply at Nuku'alofa airport and lengthy breakdowns of the HTFA plant.

GroCom is asking the Tonga government for a new fumigation plant as the current plant is old and it is difficult to source replacement parts.

MAFF meets annually with New Zealand Biosecurity, where it proposes new crops for negotiation for market access.

**Vanuatu**

Vegetable growers in Vanuatu range from small holdings to relatively large vegetable farming enterprises and a few hydroponic growers of salad vegetables. Crops include tomatoes, beans, eggplant and sweetcorn.

The Farm Support Association (FSA) is endeavouring to build the local hotel and retail markets for vegetables, and to engage smallholder growers. It provides imported seeds and grower training in production and post-harvest practices. The Ministry of Agriculture, Quarantine, Forestry and Fisheries (MAGFF) provides limited extension support. With support from the EU and a larger grower/exporter the FSA has started a project to expand smallholder production of vegetables on Tanna Island. It is proposed to send product to Port Vila by air and sea freight, although transport and logistics will need improving.
There is no local seed supply. Growers are concerned that many seeds imported are not well suited to Vanuatu conditions. Larger growers source seeds of preferred varieties from overseas, and some may further distribute this seed to other farmers. The Syndicate Agricole also imports seeds and other inputs for producers, and would like to expand its extension capability.

FSA wants to use crop protection structures during the wet summer months. It has been trialling plastic shelters and is interested in concepts being implemented elsewhere, and would welcome the transfer of agronomic knowledge from Queensland.

**Processing**

There are no local processing, freezing or food testing facilities. A small processor on Efate makes a large range of chilli and other vegetable products, but to expand would require not only building a commercial processing facility but also reliable quantities of raw material.

**Distributors**

Distribution of local and imported vegetables is mainly through larger expatriate grower/distributors, who supply the retail and food service sectors. Small growers sell through them and at wet markets.

**Consumer market**

The wet market caters mostly to locals while supermarkets target expatriates and tourists. Hotels are mainly used by Australian, New Zealand and New Caledonian visitors. Restaurants cater to tourists and the substantial expatriate community. Takeaway cafes are starting to use some local vegetables. The tourism sector buys imported produce so there are opportunities to supply this market.

**Export market**

A delegation from Vanuatu has visited Queensland to promote exports of fruit and vegetables. There is ample shipping capacity for export, but quarantine facilities will need improving before fresh produce such as lettuce can be exported to Australia, and the Vanuatu Government has been discussing market access with the Pacific Horticultural and Agricultural Market Access (PHAMA) project. It is difficult to compete in overseas markets due to Vanuatu’s over-valued currency.

**Cocoa**

**Fiji**

Fiji has minor production only, with some cocoa bean going to Australia and New Zealand.

**Samoa**

Cocoa is a major crop in Samoa, with 600t recorded in 2010. Production volumes fluctuated over the previous five years, with an overall decline of 17 per cent (FAO).

Fruiting is seasonal. Cocoa is very profitable to the farmer in a mixed farm, giving two crops a year, one in April/May and another later in the year, and an old tree can produce 30 pods three times a year.
Production

Some drier districts specialise in cocoa, on plantations established by German colonists. There is an established cocoa belt on the western side of Upolo which gives better returns than on the eastern side. While there are potential high value export markets for cocoa liquor, there is not enough supply of cocoa beans in Samoa to produce it locally, due to insufficient production and labour shortages. Many Samoans are in white-collar jobs or live in New Zealand. Moreover, their obligations to family and cultural obligations take priority, so many tend to only harvest crops for specific purposes.

Samoa’s only remaining large commercial growers, all government corporations and businesses, represent 60 per cent of commercial production. There is potential for these private producers to take over large former estates the Government is currently managing, and to import expertise in plantation management. Most other producers are smallholder growers with an average of 150 trees each. A viable farm in Samoa is said to require a mix of crops, ideally coconut and cocoa with patches of taro. The Ministry of Agriculture and Fisheries (MAF) is trying to stimulate cocoa production in integrated tree cropping systems by giving growers seedlings of cocoa, coffee and coconuts to plant five acres. There are enough seedlings backed by extension support, to plant a total of 1000 acres.

Growers also produce their own seedlings. There is little use of fertilizer, and much of the cocoa is produced under organic certification through the efforts of the NGO Women in Business. Black spot disease is a threat and always around. The Ministry of Agriculture and Fisheries (MAF) is promoting pruning to improve yield. A grower commented that older planting techniques based on use of coconut husk rather than fertiliser provided larger trees.

According to a cocoa processor, Samoan cocoa is regarded as the premium cocoa for flavouring while other cocoas are used for bulk, and its quality is far superior to elsewhere in the Pacific Islands. This is due to early German planters planting very smooth tasting cultivars, Trinitario and Crillo, which measure high on quality attributes and give a sweet aroma when roasted. These cultivars usually fetch a 100 per cent premium on world prices at T5-7/kg (AU$2.08 – 2.99), when the world price is T3.4 – 4.6 (AU$1.48 – 1.97)/kg. The processor advised that only Samoa has this quality, and there are plenty of planting resources for high grade types. However, the Samoan MAF has introduced Almenado from the Solomon Islands. With the highest rate of flowering and abundant fruit it has become the dominant cultivar, although cocoa from it is said to be acid and bitter tasting.

Processors

A processor observed that cocoa is widely processed and consumed so there is the cultural knowhow for growing and processing. Cocoa beans do not need refrigeration after fermentation, drying, soaking and pounding.

Processing of the cocoa beans is critical to quality. Most cocoa beans are processed into “Samoan cocoa”, where the producer harvests, splits and deseeds the cocoa pod; ferments it in a leaf-covered basket for five days; dries it for three days; then crushes it and puts the powder into plastic bags. This cocoa is often burnt and degraded, instead of being used to make good quality drinking chocolate.

There is a good level of technical expertise in Samoa. In previous years a small manufacturer processed bulk cocoa for Australian and New Zealand chocolate manufacturers, mostly as cocoa liquor

![Fig. 15: Pacific cocoa in Pacific Islander store, Australia](image)
where the beans are roasted, de-shelled, refined and tempered (a mechanical process to prevent crystallisation and maintain quality until reaching the next processor). He currently presses cocoa liquor to make butter and cocoa powder, while planning a new factory to process cocoa and manufacture chocolate on a small scale. Women in Business has a long-standing interest in having cocoa processed locally into cocoa powder or butter instead of exporting the bean.

**Consumer market**

Cocoa is a traditional drink in Samoa, where 600t are consumed annually. “Samoan Cocoa” is usually made into a drink with water and sugar, and is popular with tired labourers after work. The cocoa manufacturer plans to develop the local market for commercial quality chocolate.

**Export markets**

Cocoa bean exports fluctuated from 2005 – 9, with 4,850t in 2009. The world cocoa market fluctuates, but was down in 2010. Cocoa bean and solid cocoa moulded in foam cups are exported to Pacific Islander shops in Australia and New Zealand, and whole cocoa bean to the informal Samoan market in New Zealand.

A United States distributor is interested in importing cocoa bean, and large overseas manufacturers are seeking cocoa liquor. The previously mentioned processor used to sell his entire production of cocoa liquor to European manufacturers of Belgian Chocolate as it had the necessary smoothness, flavour, and taste for chocolate-making. However, there has been no apparent overseas interest in supporting export development.

**Solomon Islands**

Cocoa is an important industry, with 5,200t of cocoa bean production in 2010 reflecting 36 per cent growth since 2005 (FAO), and improved distribution systems experienced in handling cocoa. However, production has dropped to below 2,000t in recent years, so a cocoa exporter has established a locally run cocoa nursery, and distributes the seedlings directly to commercial growers and to Honiara locals on request. Production is now rising and should reach 12,000t a year. Overproduction is unlikely as there is always demand for cocoa, and a large potential market in China; however, growers need to see that cocoa is a financially viable option if they are to return to the industry.

A trader has based a small ship in Honiara to collect cocoa and copra from the Solomon Islands and Vanuatu.

Exports grew by 143 per cent from 2005 to 11,600t in 2009 valued at AU$14.8 million, mainly to Malaysia and Singapore. Cocoa bean and copra are the country's two leading earners of export income. MAF has prioritised increasing cocoa production and export. CEMA, which has supported cocoa exporting for many years and with AusAID support, now provides variety trials and selection and agronomy training to assure export quality production from the farm level.

The leading markets are Malaysia and Singapore, where Solomon Islands cocoa is considered of similar quality to that from Papua New Guinea. Exporters have had problems with the quality of dried bean. There are plans for training and facilitation to improve drying practices, establish local fermentation and grinding, and introduce certification. Having a small local laboratory would allow CEMA to test each consignment to enable quality control.
Vanuatu

Production

Cocoa production peaked at 3,200t but has since fallen to 1,500t. The industry consists of hundreds of villages each with a few trees and producing as little as three tonnes of cocoa kernel a year, so flavour varies across the crop. The growers ferment the bean to remove the skin, and the leading cocoa trader, sponsored by AusAID, has been promoting a bush dryer. Quality is good, and further improvement might increase the price by five per cent at best.

A trader exports 1,200t of Vanuatu cocoa annually. It uses a small ship to bring cocoa from the islands to its warehouse in Espiritu Santo to check, dry and remove any rubbish, to ensure consistent product and appearance.

The price paid to producers is based on the world futures price for cocoa which is determined by the large Ghana industry, and at the time of visit was GB£2,000 (AUS$3,480) a tonne, which was a very good return and attractive to the grower. The farmgate or village price is affected by freight costs, Government export costs, and small wholesale margins.

Manufacturers would prefer uniform flavour so an exporter has to supply sympathetic processors willing to manage the variability. These usually process the cocoa bean to a semi-processed state, and re-export it to a manufacturer to mould and package for local retail.

The NGO ACTIV wants to provide producers with extension support and assistance to achieve organic certification, and is seeking funding. While Oxfam provides some funding for certification through NASAA (National Association for Sustainable Agriculture Australia), this is likely to be beyond the means of a small grower.

ACTIV has started organising exporting of cocoa bean, including to New Zealand, and stores the cocoa bean until there is enough to ship, while cocoa bean from outer islands such as Malekula is shipped to Espiritu Santo for export. ACTIV sees a need to increase volumes and improve logistics to compete with commercial suppliers in export markets, and plans to build a warehouse on Port Vila for exporting.

A good local variety is used in New Zealand Fair Trade’s top selling line, a chocolate made from 75 per cent cocoa. ACTIV proposes to produce cocoa powder and chocolate, which can include other local speciality foods such as canarium nuts. There is a large potential tourist market in Port Vila, with 200 cruise liners visiting Vanuatu in 2009. A 20 per cent cocoa import duty on imported cocoa provides some local advantage.

Coffee

CIRAD (Agricultural Research for Development) in Vanuatu has been developing improved cultivars and hybrids, which Tanna Coffee in Vanuatu have been bulking up and distributing to coffee growers elsewhere.

Fiji

A proposed tourist operation near Nadi is planting Arabica cultivars.

Coffee processors operating under HACCP can have their product tested at the SPC laboratory at the University of the South Pacific in Suva.
Samoa
Old rust-prone cultivars are being replaced with the new hybrids from CIRAD, of which four semi-dwarfs are growing very well.

The NGO Women in Business facilitates exports of coffee from small producers, to a small but growing market in New Zealand.

Solomon Islands
There is a small coffee industry focussed on the domestic market.

Production
MAL has supplied producers with seedlings from five clones of Arabica coffee obtained from Vanuatu's Tanna Coffee to replace old rust-prone varieties, and also the selections CIRAD has introduced to Samoa.

Producers growing three to four tonnes of beans of highland Arabica annually at above 700 metres altitude send the bean to a central fermentation plant on Ysabel to be dried to parchment and shipped to Honiara for polishing, roasting, grinding and packaging under the “Solomon Gold” brand for local and tourist markets. The product has very good quality, and good prospects for growth, but is hampered by lack of a local supply of quality packaging and labelling.

Producers lack tools, knowledge of production and how to increase yield, and commercial sized farms to allow them to expand production.

Processors
The industry lacks processing skills, coffee processing equipment is antiquated, and the location of a very large processing facility with negligible production requires coffee growers to walk seven hours to deliver their coffee bean. A plant would ideally be located amidst the growing area.

Vanuatu’s Tanna Coffee has been collaborating with AusAID’s Community Sector Program to help the Ysabel Island community company Varivoa to develop and market a processed packaged product, “Solomon Gold” coffee, from their coffee bean, and to train management in logistics and minor training to pass on to producers. The Pacific Islands Trade and Investment Commission (PITIC) has assisted with a Japanese trade promotion and the SPC has provided food processing workshops. The company needs better label design and packaging.

Vanuatu
A small coffee industry is based mainly on Efate and Tanna, with local processing for mostly domestic consumption. The industry leader Tanna Coffee grows, processes, distributes and retails Arabica coffee under its own brand.

Tanna’s climate and volcanic soils suit coffee growing, and it has no pests that require spraying. There are 550 smallholder farmers growing coffee amidst 400ha of mixed tree crops, a relic of a former Commonwealth Development Corporation nucleus estate. During its heyday this estate’s production peaked at 62t a year but did not provide viable returns for the growers to ensure sustainability. Tanna Coffee is reviving the project, working with local producers who like to intercrop the coffee trees with taro. While this practice does retard initial coffee growth it ensures traditional agriculture is maintained and households have plentiful food supply. The project currently has 90ha of integrated crops, and production has reached 23t a year.
Tanna Coffee processes its own coffee bean and green bean shipped from Tanna at its on-farm roasting and packaging facility and tourist outlet outside Port Vila. A wet-and-dry factory on Tanna also processes green coffee bean and stores it as parchment. While quality is very good, and has won awards in Australia, some post-harvest and processing problems are yet to be resolved. A 25 per cent import duty on coffee helps the industry compete with large overseas suppliers.

Tanna coffee sells well in local hotels, resorts, gift and souvenir shops, food stores and Tradewinds Coffee and Tea, and at its factory outlet which attracts cruise and other visitors. The Australia-Pacific Technical College (APTC) at Port Vila is training baristas in coffee-making.

Tanna Coffee is exported in small quantities to Australia, New Zealand and Fiji for markets that recognise the Vanuatu origin.

Vanilla

Samoa
Samoa has a small village level vanilla industry. The University of the South Pacific has been investigating intercropping vanilla with coconut and other crops.

Women in Business assist around 30 vanilla growers, and a FACT project has brought a processor from Vanuatu to provide advice.

Solomon Islands
Hundreds of small farmers produce vanilla by intercropping and curing in sheds for local retail. The World Vegetable Centre, RAMSI and an AusAID project have been supporting industry development, including technical input from a Vanuatu processor.

Product testing has shown that quality is good but needs to be improved for export. Quality depends on climate and proper curing, but some producers have started taking shortcuts.

There is a lack of distribution except for the Varivao co-operative who have begun processing vanilla bean and making vanilla essence in Honiara, which restaurants use in bakery products, cakes and other items, but current demand is only for very small quantities.

Tonga
Vanilla production was 200t in 2010, having grown 43 per cent since 2006. Industry growth is constrained by lack of available markets and fluctuating prices and costs, with opportunistic growers often waiting three years to make any money. Small producers are not involved in marketing their vanilla.

A grower/processor produces dried vanilla bean, organic vanilla flour, and vanilla bean powder for baking, coffee and other uses, and retails it locally at around T$2.50 (AU$1.42) for a small pack. He is interested in sending vanilla to Australia.

Vanuatu
There is a small vanilla industry, and FACT is funding FSA to develop vanilla on Tanna.

Venui Vanilla is the last remaining processor, producing organically certified vanilla products, some of which are exported to Australia. On behalf of FACT the owner has provided assistance to develop the Samoa vanilla industry, and supported by AusAID and RAMSI has provided similar assistance to Solomon Islands.
FSA with the support of FACT is assisting an Organic Spice Network across the Vanuatu islands to gain organic and HACCP certification. There are issues with meeting documentary requirements for applying for organic certification. Meeting quarantine requirements of overseas markets is constrained by the lack of laboratory testing facilities required for HACCP.

**Peanuts**

**Fiji**
Some peanuts are grown commercially in western and northern Viti Levu. However, they are highly labour intensive compared with other crops. The peanuts are sold dried in bundles at wet markets and roadside stalls.

**Solomon Islands**
A small peanut industry is supported by government and NGOs. An ACIAR project has introduced nine peanut cultivars to grow the industry, and these sell at a premium at the central market. However, developing a commercial industry will require implementing a seed system to supply growers, establishing sound agronomic practice, and assessing nutritional yield.

An emerging processor has produced roasted peanuts from dry raw peanuts purchased from small producers, and is trialling peanut butter for potential development. It supplies local retail outlets and sees opportunities in cafes, a shop at Honiara Airport, and other Pacific Island countries. He cannot secure sufficient raw supply to develop commercial processing as growers of the new varieties receive better prices at the wet market than he can afford to pay. He plans to provide planting material and agronomic training to motivate growers to plant peanuts. There is minimal knowledge of and no testing for aflatoxin, indicating a health risk concern.

**Tropical flowers**

**Solomon Islands**
A small cut flower industry of producers and florists is represented by the Floriculture Association of Solomon Islands which has taken over an AusAID development project.

There is thought to be a market opportunity for cut flowers in Brisbane which has daily flights from Honiara.

**Tonga**

There is a small flower industry.

A flower trial found the cool chain for export to be inadequate, particularly road transport, reliable flights and air freight capacity, so the project failed even though there were good prices and potential markets for the products. It is believed that there is still good potential for flowers to be sent to New Zealand, possibly along the lines of bringing in tissue culture material from New Zealand, further multiplying it in Tonga and growing the flowers there, then exporting to New Zealand. It is thought this can still be done at lower cost than producing the flowers in New Zealand.
Vanuatu

There is a small flower industry. The Mamma’s Group of women growers supplies the wet market, and has had a flower workshop, but they want more training. Florists are also seeking training.

The industry is led by the Rainbow Gardens and Growforce nurseries in Port Vila. Rainbow Gardens grows thousands of tropical plants on seven hectares, mostly for hiring plants to hotels and businesses. It also supplies; its own retail outlet at the nursery; landscapers to the growing resort sector; substantial quantities of cut flowers to florists; and turf, which is strong demand. A developing range of flowers is led by Torch gingers, heliconias, Caribees, and croton leaves.

The Australian owner, a former university lecturer in business and accredited trainer, provides internal training and with funding could provide training to small flower producers and florists.

The company has been advised of a market opportunity in Australia for tropical cut flowers, indicating potential for local growers of flowers and foliage such as heliconias, crotons, golden cane and torch gingers. Rainbow Gardens could provide a base, using a local quarantine station and its own bleaching facilities.
7. Conclusions and recommendations

Conclusions
While horticultural industries vary across the six countries, a number of common constraints are apparent:

- New market development is constrained by inconsistent supply, due largely to low farmgate prices providing little incentive for loyalty to individual buyers.
- Production capacity is limited by lack of timely planting and supply of cultivars suited to end consumers and processors.
- Production systems need improving to minimise soil degradation, environmental impact and pest and disease infestation.
- Poor post-harvest handling and packaging and inadequate cool chain management and coordination are downgrading product quality, pricing, and ability to meet the import requirements of higher value overseas markets and delivery a quality product to the end consumer.
- Processing is mostly focused on low value undifferentiated products in substandard packaging delivering marginal profits.
- Processing quality and viability are affected by lack of quality standards resulting in wide variability in key processing attributes from the numerous cultivars consolidated by intermediaries.
- The level of processing knowledge and product quality management systems tend to be low.
- Higher value markets in the Pacific Islands are being bypassed for exports of low value products due to strong demand signals from overseas importers back to growers.
- Long distribution channels are not delivering the market feedback necessary to guide quality management along the supply chain.

There are opportunities for the starchy staple and the other horticultural industries investigated to:

- build domestic markets and improve food security in all countries
- improve profitability through value adding of fresh and processed products and reducing losses along the whole supply chain
- expand the value of existing overseas markets with higher value fresh and processed products and develop new markets

Recommendations
It is recommended that future activities in these countries focus on

- strengthening the entire supply chain for fresh products to both domestic and export markets
- improving the capability of processors across the range of starchy staples
- developing quality standards for products and packaging
Due to agronomic attributes and international acceptance as a versatile healthy vegetable, sweetpotato, particularly in Fiji, Solomon Islands and Tonga, was found to be the crop with most potential for commercial development.

Taro and Cassava were seen to be crops with strong potential for commercial processing development and supply chain improvement. English potato in Tonga and Fiji (as this crop develops with a rejuvenated focus from the government) would also slot into this development.

Along all product supply chains there is a distinct lack of knowledge of the reasoning and/or background to importing countries quarantine regulations. There is great need for biosecurity education of all members of the supply chain.
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Bajekal, R, Chief Executive Officer, Flour Mills of Fiji
Ram, Mr, Owner, Garden Island Root Crops
Hill, R., Ben’s Trading
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Kuna, S, Group Marketing Director, Carpenters Fiji Limited
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Vinod, V, Factory manager (Snax), Flour Mills of Fiji
Reddy, V, Group Purchasing Manager, Morris Hedstroms
Austin, G, Director, Pure Fiji International
McNeil, K, Acting Counsellor (Political/Economic), Australian High Commission
Papaya grower, Sigatoka Valley

**Samoa**

Losefa, Dr T, Lecturer in crop science (taro breeder), University of the South Pacific
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Wilson, E, Owner, Wiley - Samoa Soaps & Detergent Products
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Trenkner, L, proprietor, Volcanic Earth
Longwah, C, Owner, Kava Store
Rogers, C, Syndicat Agricole et Pastorale
Pople, D, Managing Director, Holland Commodities International and Vanuatu Copra and Cocoa Exporters Ltd (VCCE)
Eade, D, grower
Kaoh, P, Manager, Farm Support Association
Adlington, T, Managing Director, Tanna Coffee
Fisher, P, Director, Rainbow Gardens
Wallez, S, Manager, ACTIV (Alternative Communities Trade in Vanuatu)
Mackenzie-Reur, V, Owner, Lapita Café

Australia

Manager, Tara’s International Trading, Sydney
Prasad, R, Director, MC’s Indian & Island Foods, Slacks Creek, Brisbane
Pritchard, G, FMP Marketing, Sydney
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9. Appendices

Appendix 1: Indicative costs and prices

Various costs and prices were quoted and observed throughout the country visits so these are provided for future reference only. The data has not been analysed, but provides an indication of the impact of costs on prices along some distribution channels.

Table 6: Indicative costs and prices for Pacific Island taro, cassava, breadfruit, potato and cocoa

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<tr>
<th>Item</th>
<th>Costs and prices</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Taro - Fiji</strong></td>
<td></td>
</tr>
<tr>
<td><strong>On Taveuni and Savusavu</strong></td>
<td></td>
</tr>
<tr>
<td>Farmgate price</td>
<td>FJ$1.70 for whole pink; FJ$1.80 – 1.90/kg for whole pink, cleaned and de-topped; FJ$1.20/kg for white (at eight months), cleaned and de-topped</td>
</tr>
<tr>
<td>Agent’s commission for consolidating</td>
<td>10%</td>
</tr>
<tr>
<td>Wholesaler’s mark-up</td>
<td>FJ$1.70 a kg for small quantities; FJ$1.80 for bulk quantities</td>
</tr>
<tr>
<td>Freight cost on the car ferry to Suva</td>
<td>FJ$80/t freight or 10 cents/kg.</td>
</tr>
<tr>
<td><strong>On Viti Levu</strong></td>
<td></td>
</tr>
<tr>
<td>Flesh recovery from processing</td>
<td>95% after washing off dirt, 70% after peeling</td>
</tr>
<tr>
<td>Processor’s margin</td>
<td>14%</td>
</tr>
<tr>
<td>Retail price for taro crisps</td>
<td>FJ$1.70 for 45g</td>
</tr>
<tr>
<td>Export price FOB Nadi</td>
<td>FJ$2.80 – 3.00</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td></td>
</tr>
<tr>
<td>Air freight</td>
<td>FJ12 cents/kg in packing cases, FJ20 cents/kg in cartons</td>
</tr>
<tr>
<td>Air freight Nadi to Brisbane or Sydney</td>
<td>FJ30cents/kg</td>
</tr>
<tr>
<td>Air freight Nadi to Canada</td>
<td>FJ$4.70/kg</td>
</tr>
<tr>
<td>Sea freight Suva to New Zealand</td>
<td>FJ$0.07/kg</td>
</tr>
<tr>
<td>Import price in New Zealand (air freight) CIF</td>
<td>NZ$3.50/kg</td>
</tr>
<tr>
<td>Import prices CIF in Australia</td>
<td>AU$3.00/kg</td>
</tr>
<tr>
<td>Import prices CIF in New Zealand</td>
<td>AU$2.50/kg</td>
</tr>
<tr>
<td>Average export price 2009 FOB, Sydney</td>
<td>AU$1.38/kg (FAO)</td>
</tr>
<tr>
<td>Retail price for frozen Pacific taro, Sydney</td>
<td>AU$3.99/kg</td>
</tr>
<tr>
<td>Wholesaler price Brisbane Markets</td>
<td>AU$75 for 18kg fresh, large size AU$3.50 – $4.00/kg</td>
</tr>
<tr>
<td>Wholesaler mark-up, Sydney Markets</td>
<td>20%</td>
</tr>
<tr>
<td>Retailer mark-up, Sydney</td>
<td>Around 30%</td>
</tr>
<tr>
<td>Retail price for quality taro</td>
<td>AU$3.99/kg</td>
</tr>
<tr>
<td>Retail price for taro at end of shelf life, e.g. old or from fumigation</td>
<td>AU$2.99/kg</td>
</tr>
<tr>
<td>Retail price for taro leaf, Sydney</td>
<td>AU$2.99/pack</td>
</tr>
</tbody>
</table>
### Retail price at which fresh taro sells readily

<table>
<thead>
<tr>
<th>Material</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>AU$2.99/kg</td>
<td></td>
</tr>
</tbody>
</table>

### Taro – Samoa

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wholesale price to grower, delivered to depot, per bundle (basket)</td>
<td>S$20 ($1.76 – $1.47) for 11.3 – 13.6 kg basket or AU$3.25 – 3.89/kg</td>
</tr>
<tr>
<td>Colocasia corms of 600g-1kg</td>
<td>AU$3.10 (WS$1.43)/kg</td>
</tr>
<tr>
<td>Xanthosoma</td>
<td>AU$12.18 (WS$5.50)/kg</td>
</tr>
<tr>
<td>Wholesale price – cleaned and bagged</td>
<td>AU$3.63 (WS$1.64)/kg</td>
</tr>
<tr>
<td>Average export price FOB in 2009</td>
<td>AU$1.43/kg (FAO)</td>
</tr>
</tbody>
</table>

### Taro – Tonga

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmgate price</td>
<td>T$0.40 – 0.60 peeled</td>
</tr>
<tr>
<td>Price to processor</td>
<td>T$20 for a 13 – 15kg (T$0.60 – 0.80/kg peeled)</td>
</tr>
<tr>
<td>Cost of import bags</td>
<td>T$0.15 each</td>
</tr>
<tr>
<td>Processor gross profit</td>
<td>T$60</td>
</tr>
<tr>
<td>Processor margins</td>
<td>10-15%</td>
</tr>
<tr>
<td>Average export price FOB 2009</td>
<td>AU$1.38/kg (FAO)</td>
</tr>
<tr>
<td>Fresh taro export price FOB</td>
<td>T$2.00/kg</td>
</tr>
<tr>
<td>Fresh taro import price, New Zealand, CIF</td>
<td>NZ$2.50 – $3.00/kg</td>
</tr>
<tr>
<td>Retail price, New Zealand</td>
<td>NZ$3.50/kg (2kg bag = NZ$7.00)</td>
</tr>
<tr>
<td>Sydney wholesale market price in mid-2010-</td>
<td>AU$3.00/kg for any quality</td>
</tr>
</tbody>
</table>

### Cassava – Fiji

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmgate price for young cassava at 8-9 months</td>
<td>FJ$0.60/kg</td>
</tr>
<tr>
<td>Wholesaler price to distributor</td>
<td>FJ$1.20/kg</td>
</tr>
<tr>
<td>Average import price CIF for cassava starch in 2009</td>
<td>AU$0.57/kg (FAO)</td>
</tr>
<tr>
<td>Export price FOB for young cassava</td>
<td>FJ$1.20/kg</td>
</tr>
<tr>
<td>Retail price for local cassava crisps</td>
<td>FJ$1.70 for 45g,</td>
</tr>
<tr>
<td>Average export price FOB for cassava starch in 2009</td>
<td>AU$1.29 (FAO)</td>
</tr>
<tr>
<td>Retail prices, Pacific Island stores in Brisbane and Sydney -</td>
<td></td>
</tr>
<tr>
<td>• Frozen grated cassava</td>
<td>AU$4.20/kg</td>
</tr>
<tr>
<td>• Frozen &quot;marinated cassava strips&quot; from India</td>
<td>AU$1.80 for 400g ($4.50/kg)</td>
</tr>
<tr>
<td>• Tapioca powder from Thailand</td>
<td>AU$0.75 cents for 375g</td>
</tr>
</tbody>
</table>

### Cassava - Solomon Islands

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grower price</td>
<td>SD$10 a kg (AU$1.28)</td>
</tr>
</tbody>
</table>

### Cassava – Tonga

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmgate price to grower</td>
<td>T$0.40 – 0.60 (AU$0.23 – $0.34)/kg peeled</td>
</tr>
<tr>
<td>Packaging cost</td>
<td>T$0.15 (AU$0.08) a bag</td>
</tr>
<tr>
<td>Export price for frozen cassava ex factory</td>
<td>T$1.50 (AU$0.85)/kg ex factory</td>
</tr>
<tr>
<td>Average export price FOB for “dried cassava”, 2009</td>
<td>AU$0.58 (FAO)</td>
</tr>
<tr>
<td>Import price in New Zealand</td>
<td>NZ$2.50 – $3.00 (AU$1.80 – 2.34)/kg</td>
</tr>
</tbody>
</table>

### Cassava – Vanuatu

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmgate price for fresh cassava</td>
<td>60 vatu/kg</td>
</tr>
<tr>
<td><strong>Breadfruit – Tonga</strong></td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td>--</td>
</tr>
<tr>
<td>Farmgate price</td>
<td>Minimum of T$0.60 (AU$0.34)/kg</td>
</tr>
<tr>
<td>Wet market retail prices</td>
<td>T$3 – 5 (AU$1.70 – $2.85) for a basket of around 10 to 20 kg</td>
</tr>
<tr>
<td><strong>Export price for frozen breadfruit, ex factory</strong></td>
<td>T$0.80 – $0.85 (AU$0.40 to $0.48)/kg</td>
</tr>
<tr>
<td>Sea freight rates</td>
<td>T$1.00 ($0.57)/kg for the first 500kg, then T$0.50 (AU$0.38)/kg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Potato – Fiji</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmgate price</td>
<td>FJ$1.00 – $2.50 a kg (AU$0.57 – $1.43)</td>
</tr>
<tr>
<td>Retail price for local potato crisps</td>
<td>FJ$1.99 (AU$1.14) for a 45g bag.</td>
</tr>
<tr>
<td>Retail price for imported potato crisps</td>
<td>Around FJ$0.99 (AU$0.56) for a 45g bag</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Cocoa – Samoa</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmgate price for green cocoa bean</td>
<td>2 tala for 8 oz (peak season) to 10 tala (out of season), or AU$0.83 – 0.16 for 225g</td>
</tr>
<tr>
<td>Average export price FOB 2009</td>
<td>AU$1.28/kg</td>
</tr>
</tbody>
</table>

Author: AP Kim Bryceson, University of Queensland, Horticulture Component Leader

The ACIAR PARDI Program commenced in 2010. After an initial workshop held in Brisbane in March 2011 to discuss the project organisational structure and management, the Horticulture Component was asked to undertake a series of “Best Bets” Supply Chain Analyses across a number of different Horticultural crops in the six countries involved in PARDI in order to identify ‘Gaps” in the supply chain and possible interventions

Horticulture Best Bets Analyses May 2011-October 2011

The Horticulture Component Bests Bet Supply Chain Project was a preliminary approach to looking at some of the many potential Horticultural crops produced in the Pacific with the view to determining which Supply chains would be studied in depth during the remainder of the PARDI Program. The project was undertaken by AP Kim Bryceson (UQ), Ms Judy Noller (Trade Qld, DEEDI) and Mr Michael Hughes (Ag Science, Qld, DEEDI) with a Workshop open to PARDI researchers run in November 2011 to disseminate results and to discuss further work identified as being needed from the Best Bets Supply Chain Analyses.

The Methodology used in the Best Bets project was a combination of Semi structured and Unstructured interviews of actors in supply chains of Taro, Cassava, Breadfruit, Coconut (+ Sweetpotato, Salad Vegetables, Cocoa, Coffee, Vanilla, Ginger) in-country. Some 90 odd interviews in 6 countries plus visits to Brisbane and Flemington (Sydney) wholesale Fruit and Vegetable markets were undertaken.

These interviews and visits provided anecdotal qualitative evidence which was distilled by Supply Chain component (e.g. Production, Processing etc) to enable early mapping of chains, the identification of constraints and opportunities and what the Horticultural Component Team believe are some key researchables in these chains.

A list of overarching Issues that came out of the work is shown below:

- Production – varietal and associated agronomic issues
- Post harvest handling – Generally poor – rough and ready and leading to damage of product
- Processing (Value Adding) - initial attempts only – small amounts in market
- Packaging – Fresh – none, Frozen – varying quality depending on who does it
- Transport/infrastructure – poor roads, long distances, limited shipping (barges), poor and inconsistent cold chain
- Consumer Demand – unknown in reality
- Cold chain issues -reduces shelf life-negative impact on price – facilities set up but not currently used effectively (e.g. Tonga) by New Zealand Aid (Dr Michael Lay-Yee)
- Information flow/management - no information about demand flowing through to producers, information on best growing practices, processing and governance in easily digestible chunks also required
- Market access - product open to rejection from importing countries due to contamination (Heat Treatment plants – Fiji is the only one working)
- No governance – Contracts do not stand up to pressure – sellers go with price offered, traceability minimal or non-existent
- Importance of existing relationships
• Lack of Trust
• Impact on Livelihoods – Value of WoSC analysis and WoSC approach?– Costs and margins need analysis
• Impact on Livelihoods of nutritional insecurity – could be major
• Impact on Livelihoods – Health (diabetes)
• Capability Development – Business Skills lacking and needed.

Tables of results for each crop were disseminated to participants for discussion and strong points were made. Issues that were discussed in relation to each crop included commercial need, impact of the crop on the economy and livelihoods and that of any work on it, supply chain champions as a capability development tool, and applicability to the PARDI Program. A round up of potential researchables that resulted from this discussion are listed below:

- Sweetpotato – Supply Chain, Consumer specs, marketing channels/options, Supply Chain issues (Production, processing etc)
- European Veges to hotels (ACCOR), Tomato, Capsicum, red cabbage, lettuce, Consumer demands, specifications and seasonality issues
- Quality Control in processing & Logistics (primarily Cold Chain logistics and availability)
- VCO, Coffee, Cocoa should be looked at
- Atoll Specific Supply Chain of Breadfruit
- Scoping study on tropical adaptive species (seeds)
- Livelihoods / Capacity Building
  – Detailed Supply Chain (Efficiencies) models, Value Chain (Added value) Analysis

No Budget was allocated to this Horticultural Best Bets project – monies for field work and associated expenses coming from UQ and DEEDI Pardi General allocations

Total UQ (Travel, Accomodation and Incidentals for KB) = $15,041

Total DEEDI =

Current Status of Project May 6 2011 - As a result of the Best Bets Project, three SRAs on (i) Whole of Supply Chain analyses for Livelihood development; (ii) Sweetpotato Market development; and (ii) Cold Chain Logistics were developed and put to the PARDI Program Management for review. As of May 2011 (i) had been approved and commenced but neither (ii) Sweetpotato Market Analysis nor (ii) Cold Chain Logistics projects had been approved.

Recommendations to ensure that they both fitted into the raft of PRAs being developed across different organisations in conjunction with the PARDI Program are currently being analysed and incorporated into new versions of these SRAs.

As of May 2011, a further Value Adding and Processing PRA for Horticultural Crops, primarily Taro and Cassava) is currently in the process of being developed

Other Projects associated with the Horticulture Component undertaken in 2010-2011
1) SRA 2010.002 led by Dr Anand Chand of USP.

The project looked at consumer perception and acceptance of new taro varieties in domestic (Fiji - Drs Anand Chand (USP) and Amos Gyau, The University of Adelaide), and high potential export markets (Auckland – Dr Anand Chand USP, AP Kim Bryceson and Research Associates Ms Leila Esfandiarpour and Mr Guilherme Costa of UQ) It was conducted between June 2010 and May 2011.
Objectives of this project were:

1. Identify consumers’ knowledge about taro varieties;
2. Gain an understanding of consumers’ perceptions of the new taro varieties;
3. Identify the factors influencing taro buying behaviour;
4. Map the important taro sensory attributes required by consumers in both domestic and export market;
5. Assess consumers willingness to substitute new varieties for the more traditional varieties; and
6. Analyse how and to what extent these sensory characteristics can influence consumers’ choices and willingness to pay for different attributes

Taro sensory analysis was undertaken in Fiji and Auckland. In Fiji Amos Gyau undertook a survey with Anand Chand and USP Masters students. In Auckland, Anand Chand, and UQ Research Associates undertook Taro Sensory testing and a Consumer demand survey.

Outcomes of this project were: (i) a better understanding of the potential for new taro varieties to compete in domestic and international markets; (ii) an understanding of which taro varieties are most favoured; (iii) the potential size of the local and New Zealand taro markets; (iii) a clearer understanding of the consumer taro preferences, providing crucial information for the development of a PARDI root crop PRA; (iv) an understanding as to how GIS technology can be used to facilitate market determination

Budget from USP Trust Fund

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Assistant</td>
<td>$2,500</td>
</tr>
<tr>
<td>Salary (Dr. Chand)</td>
<td>$6,500</td>
</tr>
<tr>
<td>Travel (Fiji)</td>
<td>$2,500</td>
</tr>
<tr>
<td>Focus Groups</td>
<td>$1,200</td>
</tr>
<tr>
<td>Sensory Tests</td>
<td>$750</td>
</tr>
<tr>
<td>Supplies</td>
<td>$300</td>
</tr>
<tr>
<td>Sub total</td>
<td>$13,750</td>
</tr>
</tbody>
</table>

Budget from UQ Trust Fund for AP Kim Bryceson, UQ

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel (New Zealand)</td>
<td>$8,000</td>
</tr>
<tr>
<td>Research Assistance</td>
<td>$3,500</td>
</tr>
<tr>
<td>Focus Groups</td>
<td>$2,000</td>
</tr>
<tr>
<td>Sensory tests</td>
<td>$1,500</td>
</tr>
<tr>
<td>Subtotal</td>
<td>$15,000</td>
</tr>
</tbody>
</table>

Status of UQ part of this project 6 May 2011 - From UQ work contribution perspective to this SRA, one UQ Masters Coursework Project Report on Consumer Demand for Taro in New Zealand and 1 International Journal article on the “Role of GIS in Consumer Demand Analysis” are currently being completed (May 6 2011).

2) SRA
Does a Whole of Supply Chain (WoSC) approach deliver market-driven opportunities to generate a sustainable cash economy to local communities in the Pacific? Led by AP Kim Bryceson and Annie Ross (UQ), Community Engagement through Mr Milton Moloka (Solomon Islands) and Mr Sione Fakaosi (Tonga Community Development Trust).

This proposal aims to investigate the following questions through the analysis of two case studies in the Pacific – one in Marovo Lagoon, Solomon Islands and the other in Tonga where the principle investigators have previously worked and consequently have developed good ongoing community relationships.

1. Can existing small scale supply systems be expanded beyond the local level and thereby provide the capacity and opportunities for an expanded cash economy?
2. Is the WoSC approach appropriate for studying local market expansion?
3. Will a WoSC approach facilitate the development of a more market-driven business environment where opportunities to take the production of local produce beyond village markets to larger local markets (such as resorts and airports), regional markets and national markets exist?
4. Once a local supply chain is expanded, what are the impacts of this larger supply chain on local livelihoods (nutrition, health, technology uptake etc)

This proposal aims to investigate the following questions through the analysis of two case studies in the Pacific – one in Marovo Lagoon, Solomon Islands and the other in Tonga where the principle investigators have previously worked and consequently have developed good ongoing community relationships.

Budget for Project

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Int Airfares to Solomon Is, Tonga plus internal flights to field areas (2 people, 2 trips)</td>
<td>$7,600</td>
</tr>
<tr>
<td>Local Travel: Boat Hire, Car Hire, Petrol</td>
<td>$6,000</td>
</tr>
<tr>
<td>In-country field assistance (Milton Moloka and Sione Fakaosi)</td>
<td>$3,000</td>
</tr>
<tr>
<td>Accommodation &amp; Food (2 people x 40 nights ea (2 trips/country))</td>
<td>$10,200</td>
</tr>
<tr>
<td>Local Community payments (Solomons, Tonga)</td>
<td>$2,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$28,800</strong></td>
</tr>
</tbody>
</table>

Status of Project at 6 May 2011 – Preliminary Field trips to Tonga and The Solomons (Marovo Lagoon and Honiara) have been undertaken in Jan and Feb 2011 and were very successful with around 70 people interviewed.

Initial results indicate that the project should be expanded to include other Pacific Countries as cultural mores are being shown in preliminary results to have a significant impact on the uptake of the Sustainable demand-driven supply chain concept. This extension of the project to other PICs will be developed in the next 6 months as analysis progresses using UQ PARDI allocated funds.

** NOTE planned additional Field work in June and July 2011 has been delayed because Dr Annie Ross seriously broke her leg in April. It is now envisaged that the remaining Field Work (one more trip to The Solomons and one to Tonga) will take place in September and November respectively and as such this project may need an extension of 2 months to facilitate Write Up.

Other Trips and Attendance at Workshops by Horticultural Component Members in 2010

1. **PARDI Initial Trip (Fiji and Samoa – April 6-11).** Kim Bryceson, Damian Hine, Steven Underhill
2. First Workshop Brisbane (March) - Kim Bryceson, Judy Noller, Michael Hughes, Irene Kernot, Devinka Wanigesekera, Tony Onley

3. PARDI General Workshop (Nadi, Fiji (June 15-17 2010) – Kim Bryceson, Judy Noller


6. Horticulture Component Workshop (Brisbane November 8-9 2010) - Kim Bryceson, Judy Noller, Michael Hughes, Irene Kernot, Devinka Wanigesekera, Tony Onley

Other

Mrs Marg Cover has been appointed as of Jan 1 2011 on a recurring 12 month part time contract (2 days a week, HEW 6) for length of PARDI Program 50% Horticulture Program (KB as supervisor) and 50% Capability Development Program.